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CHAIRMEN OF COMMITTEES OF THE AMERICAN BREEDERS ASSOCIATION FOR 1910.

The Association owes much of its strength to the fact that a large part of the work of investigation, collation of results, suggesting plans of breeding, promoting cooperation in research and breeding, and following up of progress in this and other countries is done by committees of specialists. In this way each committee deals only with a certain phase of breeding. Committees on new subjects are appointed as appears wise and necessary.

The following-named gentlemen, nearly all of whom were chairmen last year, have been requested to serve as chairmen of the respective committees during 1910. When completed, the full list of members of these committees is to be published.

Committee on Animal Hybrids.
Prof. W. J. SPILLMAN, Washington, D. C.

Cooperative Work in Animal Breeding.
Hon. W. M. HAYS, Washington, D. C.

Breeding Wild Birds.
Dr. T. S. PALMER, Washington, D. C.

Breeding Carriage Horses.
Mr. GEORGE M. ROMMEL, Washington, D. C.

Breeding Cotton.
Dr. D. N. SHOEMAKER, Washington, D. C.

Breeding Corn.
Mr. J. DWIGHT FUNK, Bloomington, Ill.

Breeding Cereals.
Prof. C. A. ZAVITZ, Guelph, Ontario, Canada.

Breeding Fiber Crops.
Dean J. H. SHEPPERD, Fargo, N. Dak.

Breeding Forage Crops.
Dean THOMAS F. HUNT, State College, Pa.

Breeding Fish.
Prof. B. W. EVERMANN, Bureau of Fisheries, Washington, D. C.

Breeding Citrus Fruits.
Mr. W. T. SWINGLE, Washington, D. C.

Committee on Eugenics.
Dr. DAVID STARR JORDAN, Stanford University, Calif.

[Numerous sub-committees will be made committees if the Constitutional amendment carries.]

Breeding Horse Hybrids.
Prof. F. B. MUMFORD, Columbia, Mo.

Theoretical Research in Heredity.
Dr. H. J. WEBBER, Ithaca, N. Y.

Breeding Draft Horses.
Prof. W. B. RICHARDS, Fargo, N. Dak.

Breeding Wild Animals.
Mr. D. E. LANTZ, Washington, D. C.

Breeding for Meat Production.
Prof. ANDREW BOSS, St. Anthony Park, St. Paul, Minn.

Nomenclature and Registration.
Mr. H. H. MOWRY, Washington, D. C.

Breeding Nut and Forest Trees.
Prof. GEORGE B. SUDWORTH, Washington, D. C.

Committee on Prize Competitions.
Prof. P. G. HOLDEN, Ames, Iowa.

Pedagogics of Breeding.
Dean EUGENE DAVENPORT, Urbana, Ill.

Plant and Animal Introduction.
Mr. DAVID G. FAIRCHILD, Washington, D. C.

Pedigreed Seed and Plant Business.
Mr. EUGENE FUNK, Shirley, Ill.

Breeding Poultry.
Prof. JAMES E. RICE, Ithaca, N. Y.

Breeding for Dairy Production.
Mr. B. H. RAWL, Washington, D. C.

Breeding Roses.
Dr. W. VAN FLEET, Little Silver, N. J.

Breeding Sheep and Goats.
Prof. W. C. COFFEY, Urbana, Ill.

Breeding Sugar Crops.
Dr. C. O. TOWNSEND, Washington, D. C.

Breeding Swine.
Prof. D. A. GAUMNITZ, St. Anthony Park, St. Paul, Minn.

Breeding Vegetables.
Mr. W. W. TRACY, Washington, D. C.

Breeding Tobacco.
Prof. A. D. SELBY, Wooster, Ohio.

Breeding Tea, Coffee, and Tropical Fruits.
Dr. O. F. COOK, Washington, D. C.

Breeding Tree and Vine Fruits.
Prof. S. A. BEACH, Ames, Iowa.

Establishing Types and Standardizing Judging at Livestock Shows.
Col. R. B. OGILVIE, Union Stock Yards, Chicago, Ill.

Breeding Bees and Other Insects.
Dr. L. O. HOWARD, Washington, D. C.

New committees were provided for at the last annual meeting, as follows:

Breeding Drought Resistant Crops.
Dr. W. X. SUDDUTH, Billings, Mont.

Exportation of Pedigreed Animals.
Prof. H. W. MUMFORD, Urbana, Ill.

Importation of Pedigreed Animals.
Mr. E. B. WHITE, Leesburg, Va.

Committee on Finances.
HON. WILLIAM GEORGE, Aurora, Ill.

CHARLES ROBERT DARWIN.

THE AMERICAN BREEDERS MAGAZINE

"The organic world as a whole is a perpetual flux of changing types."—FRANCIS GALTON.

Vol. I. **First Quarter, 1910.** **No. 1.**

THE NEW MAGAZINE HAS A PLACE

Six years of successful life have proven that the American Breeders Association was organized to meet a need. This Association has brought animal breeders and plant breeders to realize that they are working under laws of heredity common alike to animals and plants. Practical breeders are beginning to understand that they need the work of the scientists who study heredity and breeding; and the scientists have proven to themselves the wisdom of being in close touch with the breeders. The annual reports of the Association have demonstrated the value of a literature covering all phases of heredity and practical breeding. Recent work in heredity and improved breeding has inaugurated a new era in research, in improved methods, and in the demand by growers for improved plants and animals. As an exponent of the newer and more scientific phases of this subject the American Breeders Magazine will have an important place.

Results already secured clearly show that our plant and animal breeders can greatly increase the product from most plants and animals used in agriculture. The experts believe that breeders can find ways of improving varieties and breeds which produce at least five billions out of the eight billions of dollars worth of our farm products. Judging from achievements already accomplished, 10 per cent is a conservative estimate of the increase which can thus be made.

The half a billion annually of added product which may thus be secured with small outlay is a great incentive for the breeders and the scientists who aid them.

Improvements by breeding are unlike those secured by adding new acres to the cultivated areas of the country, by deeper plowing, by more frequently cultivating the crop, by adding to the soil larger supplies of fertilizers, or by giving a more expensive ration to farm animals. These improvements, though they greatly increase the farmers' profits, are secured at a cost which sometimes equals the value of the added product. But the cost of improvements through breeding usually represents only a small fraction of the added

values. The increase of product secured by breeding pays the cost in a short time, and, since there is no further expense, the annual increase afterward is clear profit. The farmer will be able to retain a part of the larger production in the form of added profit, and part will help to reduce the cost of living to those in our cities. Larger production on the farm will also give increased business for the transportation company, the manufacturer, and the merchant, and will provide the nation with a larger product with which to hold our balance of trade.

Many of the scientists, teachers, and advanced breeders who are to contribute the scientific matter for the magazine and carry the burden of the editorial work and management are already enlisted. They are ready to contribute their time in committees, in research work, in preparing papers, and in attending the annual meetings of the Association.

James Wilson

DARWIN, MENDEL, AND CRUIKSHANK.

The lives of the men whose pictures are given on three previous pages were contemporaneous. The middle of Darwin's life (1809 to 1882) was 1846; of Mendel's (1822 to 1884) was 1852; and of Cruikshank's (1808 to 1895) was 1852. Each man, following his own bent, wrought in a new field and each won the highest eminence as undisputed leader in his chosen work. Darwin's wonderful assembling, coordinating, and philosophical use of the biological data of his time in giving an adequate theory of the evolutionary development of living organisms, placed him at the pinnacle of fame for the century. Mendel's most brilliant stroke of genius, which led him to mathematical research concerning the unit characters of plants and animals, leading to a knowledge of the laws of segregation, of dominance, and of recombination, made him a great world benefactor. Cruikshank's achievement in showing how to use the blood of a valuable mutant, the Shorthorn sire Champion of England, was likewise the work of a genius. No other achievement in making use of the blood of a mutant has reached the proportions of the results attained by Cruikshank's cattle.

The facts wrought out, the achievements in modifying plant and animal forms, and the theories deduced by these three men form chief pillars in a structure upon which rests the modern science of heredity and breeding. The present knowledge of heredity and breeding places a different rating on the fathers of the science of breeding than did the less definite philosophy of a generation, even a decade, ago. Another decade may make as great a change in this science as has the decade since Mendelism was exploited by Mendel's disciples. As in mechanics and electricity, the development of the science and use of the knowledge of heredity seems but in its beginning.

Darwin, better in position to understand the importance and bearing of Mendel's discoveries than any other savant of that time, unfortunately did not know of Mendel's work. The possession of the facts of Mendelism would have been a powerful aid to Darwin, and would probably have given certain phases of Darwin's work a different aspect.

GREGOR JOHANN MENDEL.

CHARLES ROBERT DARWIN.

1809 - 1882.

Darwin coming of a family of scientists and naturalists, the lines of descent favored in many ways the development of the genius which he possessed. His father, Dr. Robert W. Darwin, was a physician of note and a man of unusual qualities of heart; known as a judge of men and an unerring reader of human nature, and withal of strongly scientific and philosophic trend. Darwin's mother was a woman of culture and accomplishments, the daughter of Josiah Wedgwood, the manufacturer of the well-known pottery ware of that name. The paternal grandfather, Erasmus Darwin, was a physician and scientist of note.

Darwin studied at Edinburgh University and later at Cambridge, taking his degree in 1831. The same year he joined a scientific expedition around the world on H. M. S. Beagle, returning after an absence of five years. His studies during this extended voyage furnished him with much material and really laid the foundation of his future career as a scientist. It is asserted that the study of the fauna of the Galapagos Islands suggested the ideas that led to his theory of evolution.

Simplicity and gentleness of manner, kind disposition, and personal charm were qualities which made Darwin universally esteemed. He was a man of independent means. At his country seat at Down he pursued his studies in his quiet, orderly, and systematic way. He possessed marvelous powers of observation; in his experimental work he was quick, accurate, and painstaking. He was a profound thinker. It is said of him that he wrote with difficulty, but he worked at his manuscripts with rare patience, and his writings are clear, logical, and convincing.

Darwin's book, "The Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life," appeared in 1859, making an epoch in the history of science. He published considerable in various fields of natural science, but nearly all his publications were elaborations and additions to his theory of evolution.

No other man of modern times has so profoundly influenced the world of science. His followers have made many deductions

which Darwin would not make. The greatness of his mind was best shown by the sane and safe point of view to which he adhered during his last years, when biological and theological discussion aroused by his writings was intemperate and controversial to a high degree. Those of his disciples who were over-radical now appear at a disadvantage beside his calm utterances, as do also the statements of those then most radically differing with his views.

GREGOR JOHANN MENDEL.

1822 - 1884.

Gregor Johann Mendel, the discoverer of what is now known as "Mendel's Law," and what is ranked as one of the greatest and most important discoveries in biology, was born in Silesia, Austria. His parents were farmers in fair circumstances After having been ordained a priest in 1847, he studied the natural sciences at the University of Vienna. The love of nature which came to him through a long line of farmer ancestors asserted itself in his tastes and studies.

He found time from his duties as priest in the Cloister at Bruenn to follow his bent. Here he did much highly scientific work in breeding and hybridizing plants, using chiefly the varieties of the table pea, but including other species as lychnis and thistles.

It seems that the biological thought of Mendel's day did not realize the bearing and importance of his work. His writings reposed apparently forgotten in an obscure publication until 1900, when DeVries, Bateson, Tschermak, Correns, and Spillman rediscovered the facts of Mendel's Law and confirmed them, Correns at the same time discovering Mendel's manuscript.

Mendel was a man of numerous attainments. He taught at the High School at Bruenn, and at one time managed a bank. He was versed in meteorology, on which subject he wrote several papers; but on the whole he published little.

The painstaking character of the work which led to his now famous discoveries are an inspiration to students of biological processes to plan clearly and to execute faithfully all details. But his results, which, though so astounding, were so little appreciated by

AMOS CRUIKSHANK.

the biologists of his time as to receive no notice in concurrent literature, have given a new point of view and a new inspiration to biological thought and research. He has brought into the clear light the fact that unit characters are projected with mighty power through successive generations; and that the definite forces which carry these characters forward in heredity often preserve their identity when in conflict with opposing characters, retaining their unity as organic entities through a long series of generations. He showed that gametically pure heredity carriers can crowd their opposing characters out of one-fourth of the progeny, and that recombination of pure characteristics from two or more parent varieties or breeds can be effected, thus enabling the breeder to produce improved varieties and breeds in which two or more recombined characters are retained pure, and with their full power of projected efficiency in the new variety or breed.

Mendel's discoveries are leading to a clearer knowledge of heredity and breeding. The application of his principles in hybrid breeding for practical purposes has gone forward somewhat more slowly than those who have done most to bring them before the public predicted. On the other hand, the study of heredity has been accelerated beyond the dreams of those most optimistic a decade ago.

AMOS CRUIKSHANK.

1808 - 1895.

Amos Cruikshank stands out as probably our greatest example of a master breeder of animals. Personally, he was a man of sterling worth, simple in his tastes and of lofty character. He was greatly beloved by all who knew him. He came of a Quaker family and was a man of deep religious convictions.

Amos Cruikshank was born on a farm at Kinmuir, near Inverness, Scotland. In 1837, together with his brother Anthony, he leased Sittyton, a farm of about 250 acres, 12 miles from Aberdeen, and began the breeding of Shorthorn cattle. Amos had entire charge of the farm and the breeding herd. Anthony during the first period furnished the financial backing. Their holdings were eventually in-

creased until the farm comprised a thousand acres, which during the period of greatest activity carried about 300 head of cattle.

The management of this large breeding farm was of the plain and practical sort. No attempts were made at ostentation, nor was the stock pampered or artificially forced. Cruikshank was impartial to color. True, there was a predominance of red in his herd. The reason was that he endeavored to meet the demands of purchasing breeders who came from the United States and Canada. But that in his mind quality was uppermost is shown by the fact that the great bull, Champion of England, was a roan.

Sittyton and its master first came into prominent public notice when a bull of his breeding, Marshal of Windsor (then belonging to William Duthie), was chosen to head the royal herd at Windsor.

First among the forces leading to Mr. Cruikshank's success was his acquisition of an animal, Champion of England, the blood of which was projected with such high efficiency into his progeny, and this blood so well endured rather narrow inbreeding that it was capable of serving as the basis of a prepotent sub-breed of Shorthorn cattle of the type in demand in England, America, and other countries.

Second may be placed Mr. Cruikshank's analysis of his own work, and the judgment he adhered to, in spite of advisers to the contrary, to breed his bull's blood sufficiently narrow not to dissipate its prepotency, that he might supply that blood in relative purity in quantity to many breeders.

The blood from Mr. Cruikshank's stock, commonly called Scotch Shorthorns, may be found in nearly every herd of Shorthorns in existence. He devoted his life to the building of a strain of Shorthorn blood which practically revolutionized that breed. The progeny of Champion of England met the need and demand of the time for a blocky, easy feeding, early maturing, beefy type of cattle, in which milk-giving was not a prominent characteristic, and especially strong in the show-ring, at a time when outward appearance rather dominated live-stock philosophy.

INCREASING PROTEIN AND FAT IN CORN.

LOUIE H. SMITH, *University of Illinois.*

PROGRESS OF EXPERIMENTS IN BREEDING CORN TO INFLUENCE SPECIAL CHARACTERS.

The purpose in presenting at this time a matter which may not be altogether new to most of our members is to bring before this Association the latest results of what are probably the oldest corn-breeding experiments in existence.

Some of the records now cover thirteen generations, and to those who have been watching the progress of the work, the interest naturally grows more intense as the years go by. The records become more and more valuable as they accumulate as throwing light, not alone upon those questions connected specifically with corn improvement, but also upon some of the broader general problems of heredity.

In 1896 the Illinois Experiment Station took up the proposition to influence the chemical composition of the corn kernel by selection of the seed. It will scarcely be necessary to give here more than a mere outline of the general plan of the work. The history and results of these experiments for the first ten generations are given in detail in Bulletin 128 of the Illinois Experiment Station.

The plan proposed was to breed for four different purposes, namely, (1) increase of protein; (2) decrease of protein; (3) increase of oil; (4) decrease of oil; the selection being based upon the analysis of individual ears of a single variety. The ears thus selected for the several purposes were planted together in isolated breeding plots by the well known ear-to-row method. From each of these plots selection has always been kept up in the same general manner by analysis of individual ears.

BREEDING TO INFLUENCE THE PROTEIN CONTENT.

An outline of the results obtained in the breeding for increase and decrease of protein content may be seen in Table 1.

Table 1 gives the average protein content of the crop produced on each plot each generation, thus giving a good general view of the progress of the work.

A glance at the figures shows that there has been great response to the selection in both directions, so that the general effect has been such that we have been able to produce, out of a single variety, two strains of corn, one of which contains more than half again as much protein as the other.

TABLE 1.—*Increase and decrease of protein.*

Year.	High protein plot average in crop harvested.	Low protein plot average in crop harvested.	Differences between crops.
	Per cent.	*Per cent.*	*Per cent.*
1896	10.92	10.02	0.00
1897	11.10	10.55	0.55
1898	11.05	10.55	0.50
1899	11.46	9.86	1.60
1900	12.32	9.34	2.98
1901	14.12	10.04	4.08
1902	12.34	8.22	4.12
1903	13.04	8.62	4.42
1904	15.03	9.27	5.76
1905	14.72	8.57	6.15
1906	14.26	8.64	5.62
1907	13.89	7.32	6.57
1908	13.94	8.96	4.98

It is important to notice in passing that there has been at times a very pronounced seasonal influence upon the protein content. For example, the high protein tendencies are brought out very distinctly in the results for the years 1901 and 1904. On the other hand, 1900 and 1907 were years favorable to low protein.

BREEDING TO INFLUENCE THE OIL CONTENT.

Even more striking are the results obtained in the breeding to influence the oil content as shown in the more regular and uniform response to the selection and in the greater proportionate changes produced.

Table 2 gives the record of this work. Here it is shown that the general effect has been to produce out of this same variety two other strains of corn, one of which is now practically three times as rich in oil as the other.

It is of especial interest to observe that both in the oil and in the protein breeding the limits appear to have been reached. In the case of the high protein the high percentage in the crop of 1904

has never since been attained. In the low-protein plot the minimum percentage thus far obtained was in the crop of 1907. In the high-oil strain, there was a drop in the percentage of the last year's result, but in the case of the low oil the extreme point is represented in the last year. On the whole, however, if we consider the last four or five generations, the results appear to be fluctuating around certain points, varying back and forth with the season and soil conditions.

TABLE 2.—*Increase and decrease of oil.*

Year.	High oil plot average in crop harvested.	Low oil plot average in crop harvested.	Difference between crops.
	Per cent.	*Per cent.*	*Per cent.*
1896	4.70	4.70	0.00
1897	4.73	4.06	0.67
1898	5.15	3.99	1.16
1899	5.64	3.82	1.82
1900	6.12	3.57	2.55
1901	6.09	3.43	2.66
1902	6.41	3.02	3.39
1903	6.50	2.97	3.53
1904	6.97	2.89	4.08
1905	7.29	2.58	4.71
1906	7.37	2.66	4.71
1907	7.43	2.59	4.84
1908	7.19	2.39	4.80

On account of these environmental influences, it cannot be decided yet whether there may not still be further advance possible in some of these directions, and there is still as much interest as ever, if not more, in the continuation of these experiments along the same lines.

THE QUESTION OF REVERSION.

The question that this work most frequently calls out is in regard to the permanency of these characters. Will it require constant selection to retain these qualities or will they revert to the original condition if left without special selection? Some interesting data bearing upon this point have been obtained in connection with the high-oil corn.

In 1903, after the high-oil strain had been selected for six generations and the oil content had been increased up to 6.50 per cent, two selections of ears from this plot were made for other purposes quite independent of oil content, namely, for erect ears and for

declining ears. These two new strains have been bred in separate plots since that time, with no attention whatever given to percentage of oil in the selection of seed. Incidentally we have, however, analyzed the crops harvested and the results of these analyses are given in Table 3.

TABLE 3.—*Composition of erect ear and declining ear plots.*

Year and strain	Oil.
	Per cent.
1896—Original corn...	4.70
1903—High oil	6.50
1905—Erect ear	6.90
Declining ear ..	6.60
1907—Erect ear	6.65
Declining ear ..	6.23
1908—Erect ear	6.37
Declining ear..	6.02

From these results it appears that in 1905 after two generations of non-selection there was an actual increase of oil; in 1907 after four generations the percentage was about the same as at the beginning of the new plots. In 1908 there was a decrease apparent which may quite possibly be the effect of a "low-oil season."

On the whole, we may say that after five generations of non-selection, there is certainly no great decrease of oil content, but in view of the fluctuations due to environment, it is too early to draw final conclusions in regard to this point.

A theoretical discussion of great interest is involved in these data, but it is the present purpose simply to put on record here these facts as they have been found, hoping to have the opportunity at some later date to present for more thorough discussion this phase of the experiments.

EFFECT OF SELECTION UPON PHYSICAL CHARACTERS OF THE PLANT.

Some other interesting examples of what may be accomplished by continuous selection for special purposes are furnished by some experiments designed to influence certain physical characters of the plant, namely, the height of the ear on the stalk and the position of the ear at maturity, with reference to the angle at which it hangs.

SELECTION TO INFLUENCE HEIGHT OF EAR.

Seven years ago two lots of ears were selected from an ordinary corn field, one of these lots representing ears growing high on the stalk and the other those borne low down on the stalk. These two sets of ears were planted in separate breeding plots, and selection for high ears and for low ears from the respective plots has been made each year since.

The general results of this work are shown in Table 4.

TABLE 4.—*Breeding for high ears and low ears.*

[Average height in inches.]

Year.	High ear plot.	Low ear plot.	Difference.
1903	56.4	42.8	13.6
1904	50.3	38.3	12.0
1905	63.3	41.6	21.7
1906	56.6	25.5	31.1
1907	72.4	33.2	39.2
1908	57.3	23.1	34.2
1909	64.3	25.3	39.0

Here again as in the case of the selection for composition of grain, there has been a gradual response so that by breeding this variety in opposite directions two strains of corn have been produced in one of which the ears are now borne about three feet higher on the stalk than in the other strain.

Incidentally it is of interest to notice in this connection the correlation existing between the height of ear and the total length of plants, the total number of internodes, and the average length of internodes. Selection for high ears has produced a taller, later maturing plant than that resulting from low-ear selection; and interesting enough from the practical standpoint, the yields from these two strains are thus far about equal.

SELECTION TO INFLUENCE DECLINATION OF EAR.

Another character that has likewise responded in a striking manner to seed selection is the declination of the ear at the time of maturity. The details of the plans and the early results of this work, together with those of the preceding experiments will be found in Bulletin 132 of the Illinois Agricultural Experiment Station.

The results now cover six generations, and they appear in outline in Table 5.

TABLE 5.—*Breeding for erect ears and declining ears.*

[Average angle of declination from stalk.]

Year.	Erect ear plot.	Declining ear plot.	Difference.
	Degrees.	*Degrees.*	*Degrees.*
1904	42.0	45.0	3.0
1905	62.2	117.1	54.9
1906	49.5	76.2	26.7
1907	42.3	81.6	39.3
1908	46.0	88.5	42.5
1909	31.2	110.7	79.5

We observe from these results that, with the exception of 1905, which appears in this respect to be an abnormal season, there has been a steady progressive response to the selection, until finally after six generations the average difference in the angle amounts to almost 80 degrees.

CONCLUSION.

Aside from their practical significance, there is a peculiar interest attached to these results as representing in every instance what has been accomplished by the method of breeding, sometimes designated as "continuous selection," a method in which some investigators would appear to have little faith. It should of course be recognized in this connection that we are dealing here with an open-fertilized plant. It would be interesting to have on actual record the results of parallel experiments with some self-fertilized plant such as wheat.

[Professor Smith's article splendidly represents those well-conceived experiments in heredity and breeding which are placing these subjects on a scientific basis and are showing that large economic results may be secured. Though this particular experiment was not begun with such a thought in mind, it may be that strains of corn thus made highly efficient and pure-bred in specific lines may be found useful as the basis of hybrid breeding. In other words, the characters thus highly intensified and made pure-bred may be recombined in first-year hybrids, or in fixed hybrids, which have the desired very large value per acre. This also is an illustration of the

fact that scientific work which is prosecuted primarily for science's sake often leads to economic results of large value. Here not only is the scientific proof secured that profound changes in the heredity of corn may be made, but that varieties which were not bred for all round per acre value may prove useful as the constituent units of new varieties. Corn breeding under the ear-to-row centgener plan was begun by the Minnesota Experiment Station in the early nineties; and the resulting now widely used "Minn. No. 13" Corn was widely distributed in the late nineties.—W. M. H.]

NEW METHODS OF PLANT BREEDING.

GEORGE W. OLIVER, *U. S. Dept. of Agriculture, Washington, D. C.*

During the past few years the writer has spent considerable time in crossing certain vegetables and field crops, including some composites and legumes whose flowers, owing to their small size and very minute sexual organs, have been considered very difficult or impossible to manipulate in order to make desired crosses. Among the number of plants dealt with were the lettuce and alfalfa, and an account of how to prepare their flowers will be sufficient to give the beginner a few hints as to the best way to proceed to cross flowers having minute sexual organs and arranged in such a manner as to preclude the use of ordinary methods.

CROSSING DISTINCT VARIETIES OF LETTUCE.

In crossing two lettuce plants belonging to different varieties the work is rendered easy of accomplishment if the seed of both parents is sown early in the spring so that the plants will bloom in moderately warm weather and preferably indoors. In the cold months flowers are not easily produced indoors, and this is especially true of the heading varieties. Lettuce plants usually begin blooming only one flower the first day, the number increasing gradually; therefore the seed of the proposed pollen-bearing parent may be sown in the greenhouse and the seedlings planted a week or two in advance of

those of the proposed seed bearer, so that abundance of pollen will be available when the first flowers of the female parent open.

The early maturing flowers should be used in crossing as they usually are the strongest and it is natural to suppose that the resulting seed will be well developed.

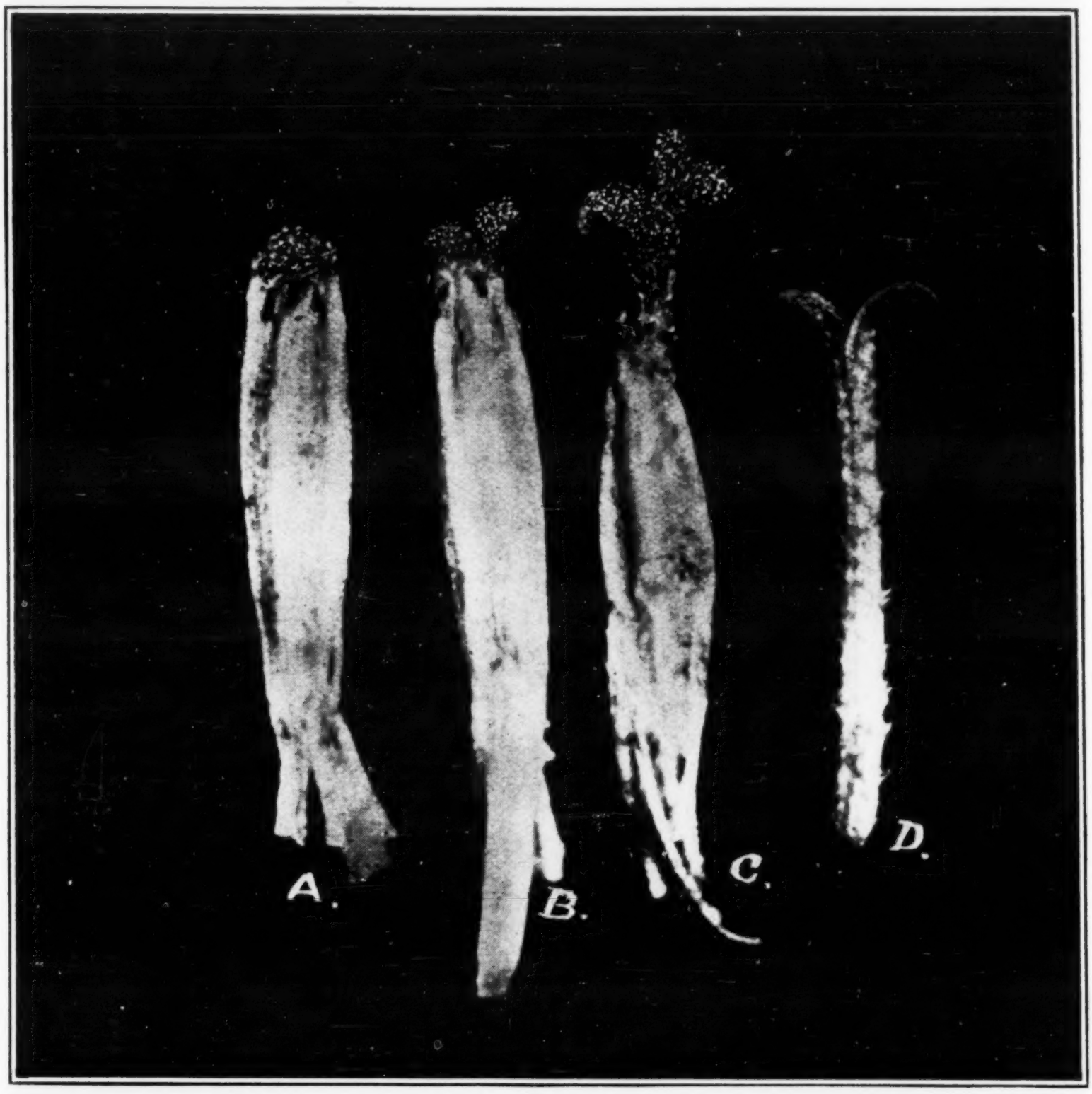

FIG 1.—STAMINAL TUBES AND STIGMAS OF LETTUCE FLORETS (greatly enlarged).

A. Staminal tube from which the pollen is being pushed out by the pistil. B. C. More advanced stages. D, Stigma cleared of pollen by water.

The ligules of the lettuce flower head begin to expand early in the morning but the pistils do not mature until after the ligules are fully expanded, say, from 8 to 10 A. M., according to whether the weather be warm or cold.

The lettuce flowers are self-pollinating, and the pollen being slightly adhesive it is not carried from flower to flower by atmospheric disturbance. Insects are but seldom observed on the open flowers, nectar is probably absent and the flavor of the pollen grains is distasteful to pollen-eating insects. There is little doubt that the pollen from one head of florets seldom reaches that of another through the agencies of wind or insect interference.

The lettuce flower heads do not have both ray and disk florets like most other genera of the composite family such as the chrysanthemum, dahlia, and helianthus. All of the florets in each flower head of the lettuce are alike. Each one consists of a single ligule or strap-shaped corolla, stamens and pistil. In the other genera mentioned the outer or ray florets have each a single ligule either broad or narrow, some of the species have neither stamens nor pistils in the ligules or ray florets, others have the pistils developed. The disk florets in the central part of the flower head have both pistils and stamens present and the corolla of each one is regular. (Fig. 2, B. C. D.)

With a low-power magnifying glass examine the flowers of the lettuce as soon as the ligules are developed and note the development of the pistils. As soon as the two lobed stigmas are expanded each one will be found to be covered with the pollen from the stamens of its own floret. It is now too late to think of emasculation, and even during the earlier stages emasculation is out of the question because of the minute size and position of the stamens. Before the top of the pistil is exposed to view the anthers have already dehisced and the lengthening pistil aided by the minute hairs along the style force the pollen out of the top of the tube formed by the union of the anthers. (Fig. 1, A, B, C.) During the period before the lengthening of the ligule and before the stamens dehisce the small size and peculiar arrangement of the stamens will not permit of emasculation without injury to the pistil.

When the pistil is fully developed the pollen grains resting along the stigmatic surface (Fig. 1, A, B, C) have not yet sent their tiny tubes into the tissue of the stigma, therefore the removal of the pollen before this takes place, which we may call depollination, effectively takes the place of emasculation.

To depollinate the flower thoroughly so that every grain of pollen may be removed not only from the stigmas but also from the ligules

and to become thoroughly familiar with the details of the operation. remove a fully developed head from a plant, take the pedicel of the flower between the thumb and forefinger of one hand with the ends of these two fingers close up to the ligules; then train a tiny jet of water from a chip blower (Fig. 5, A, B) on to the stigmas perpendicularly

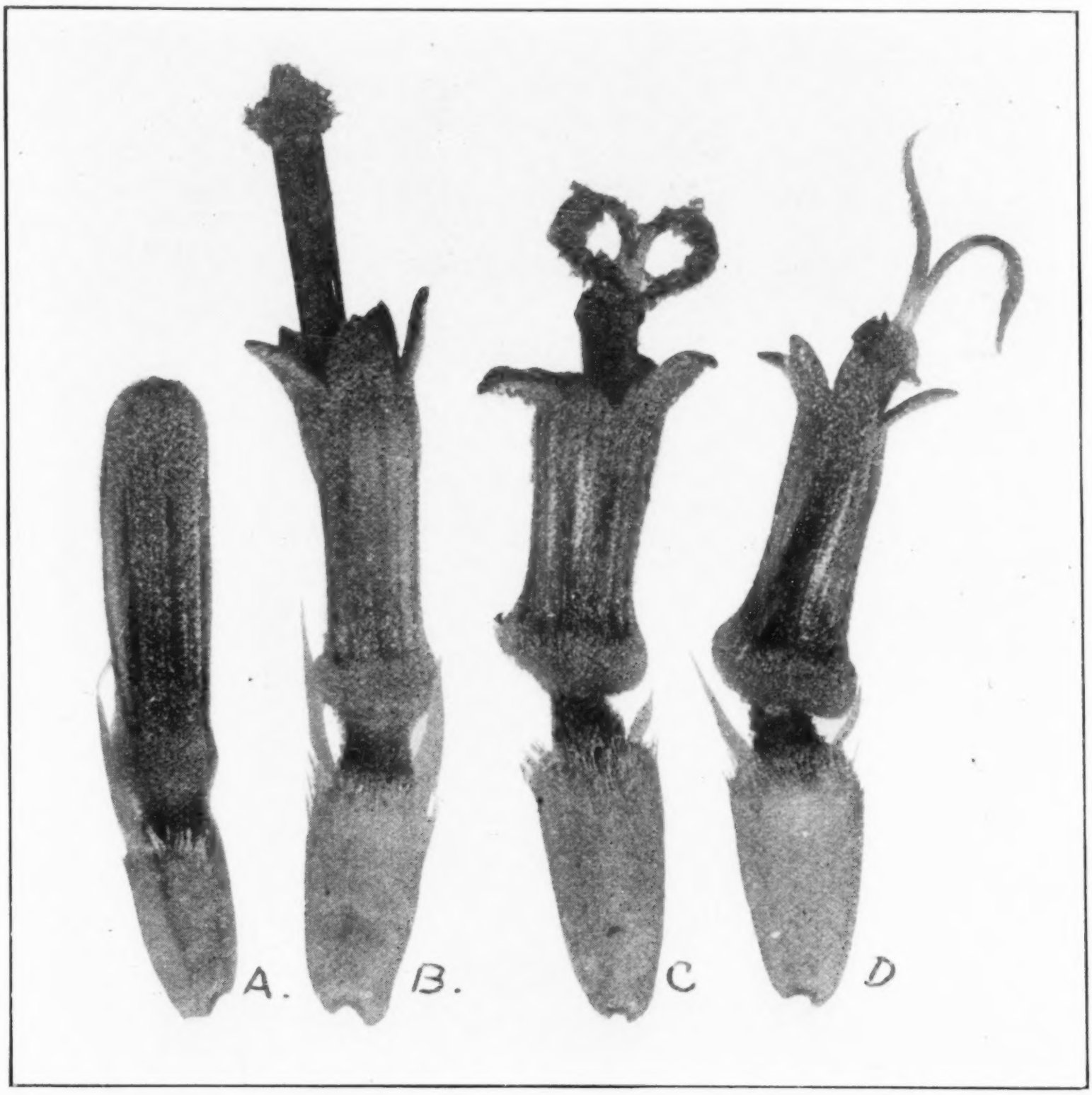

FIG. 2.—DISK FLORETS OF HELIANTHUS (enlarged five diameters).

A. The bud stage. B. Pollen is being pushed out of the staminal tube by the pistil. C. The stigma is covered with pollen. D, Depollinated stigma.

for a few seconds to remove the pollen grains. With a small piece of blotting paper applied edgewise to the various parts of the flower head enough of the water covering the floral parts will be removed.

The flower head should now be examined through a hand lens to ascertain if the time allowed for the jet of water to play on the stigmas was sufficient for depollination; this will give a pretty exact idea of the time required for depollination. At the same time if the jet of water was not too strong it will be seen that the pistils have been left absolutely uninjured. (Fig. 1, D.)

In order to acquire practice in the simple act of pollinating the stigmas after they have been successfully depollinated, lay the depollinated flower to one side, then pick a flower from the proposed male parent, examine with a lens and if the stigmas are covered with pollen apply them with a slight circular motion to those of the flower which has been depollinated, then examine the pollinated flower with the lens. If the pollen was plentiful on the stigmas of the proposed male, every stigma of the proposed seed bearer will have several grains on its surface.

The method described above has been successfully applied to the flowers of several genera of the compositæ and when it is possible for two plants to intercross, the merely mechanical part of the work is by its use made extremely simple. Flowers of many plants of the other orders have also been successfully dealt with by modifying the method according to the structure of the flowers.

CROSSING ALFALFA.

It is perhaps in the crossing of a few of the desirable forms of *Medicago sativa* with the species of alfalfa recently introduced from Siberia that this method will be instrumental in securing the desired strains possessing hardiness for those large areas having very severe winters with but little snow protection. The methods hitherto used in crossing this tiny flower have not produced satisfactory results. They have been of a slipshod nature, such as inserting a pointed piece of wood, on which grains of pollen have been dusted, into the suture formed by the outer edges of the keel and pressing against the sexual column until it trips, the idea being that when the sexual column is sprung the stigma will press against the pollen grains and imbed some of them in the soft surface of the stigma. The flower buds are sometimes emasculated at a very early stage; this is necessary because the anthers dehisce while enclosed in the unopened bud (Fig. 4, A, B), but the pollen remains inoperative while the sexual column

remains unsprung. Emasculation in the bud stage, however, is almost certain to injure the pistil sufficiently to insure its collapse.

Since the discovery of the method described below there is no necessity for failure in crossing alfalfa flowers if the details are faithfully carried out.

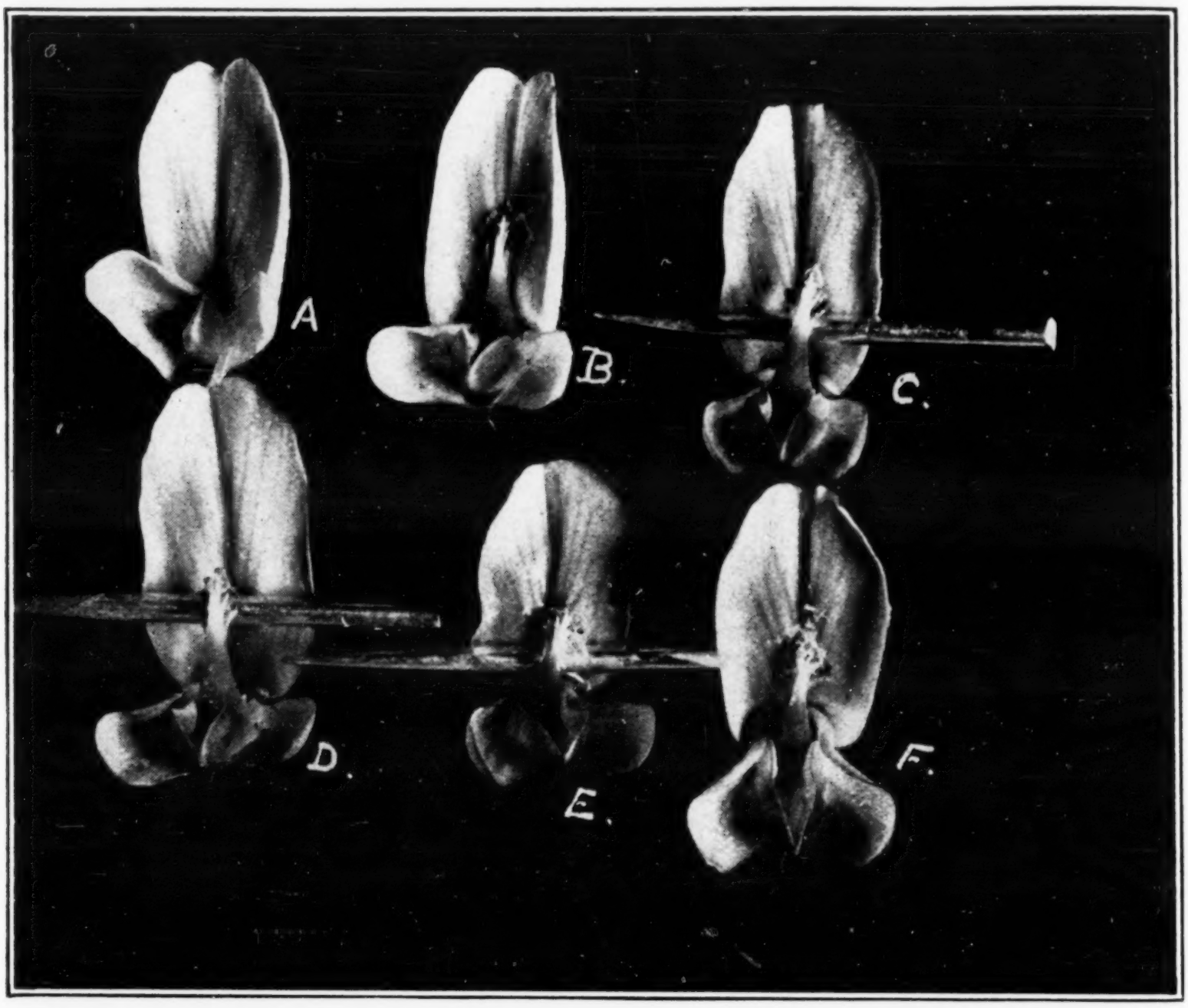

FIG. 3.—FLOWERS OF ALFALFA, SHOWING METHOD OF DEPOLLINATION AND CROSSING.

A, Untripped flower of alfalfa. B, Tripped flower. C, Sexual column tripped on piece of pin. D, Stigma depollinated by water. E, Stigma pollinated while sexual column is resting on pin. F, Pin withdrawn, allowing pollinated stigma to press against banner.

The beginner should examine the treated flowers with a hand lens at first to ascertain for future guidance just how much of the treatment is necessary in depollinating.

It is desirable to work with strong plants in pots in the greenhouse and if all the species and varieties necessary can be grown to flower early in the season then protection from insects is unnecessary. Select

strong racemes of flowers, cut off all the old flowers and buds, having three or four open flowers just below the largest buds, as these open flowers are more likely to respond to artificial pollination than unopened flowers and those at the lower part of the raceme.

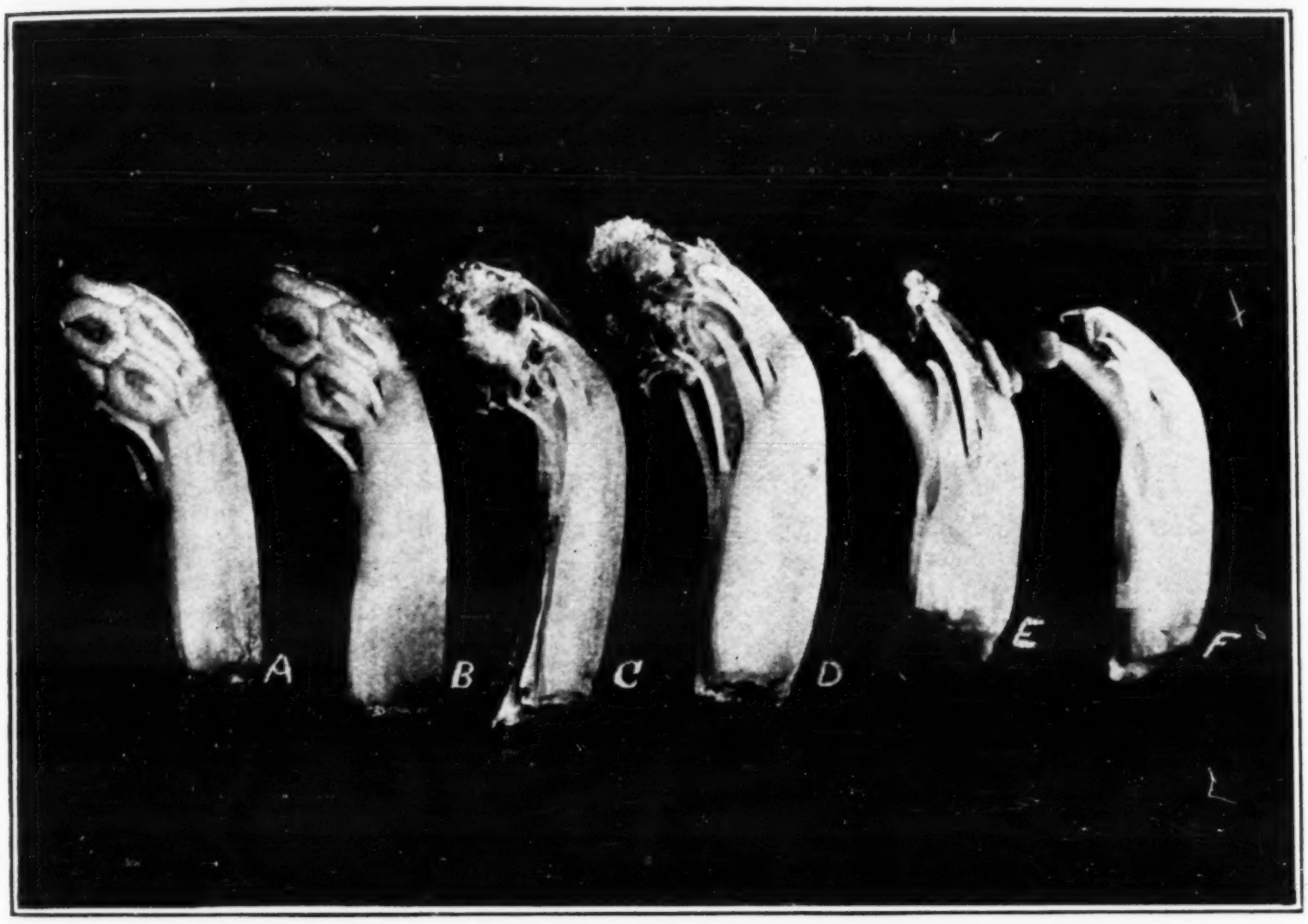

FIG. 4.—SEXUAL COLUMNS OF ALFALFA FLOWERS IN DIFFERENT STAGES.

A, B. Sexual columns from flower buds before the stamens have dehisced. C, D. Sexual columns from flower buds, with stamens dehisced. E, F. Sexual columns from which the pollen has been removed by water.

The necessary tools are as follows: two pairs of scissors, those shown in Fig. 6, A, are most convenient for removing the banners of flowers when securing pollen; those shown in Fig. 6, D, are used in removing flowers and buds not wanted on the raceme used as the seed bearer.

The self-closing forceps (Fig. 6, B) are very useful in holding the sexual column of the male in pollinating. The forceps shown in Fig. 6, C, are necessary in tripping the flower of the male when the pollen is applied direct from the sexual column. The chip blowers and other devices seen in Fig. 5, A and B, are used in applying water in depollination. Some small pins cut in half, a few pieces of blotting paper, watch glass, and camel's hair brushes complete the outfit.

In beginning the work of cross pollinating alfalfa by the method here described, one must bear in mind that no part of the flower of the seed bearer is to be mutilated. It should therefore be understood that in the open flowers while the sexual column is still unsprung from its place within the keel (see Fig. 3, A), the anthers have dehisced and the pollen is packed in masses around the stigma (Fig. 4, C and D)

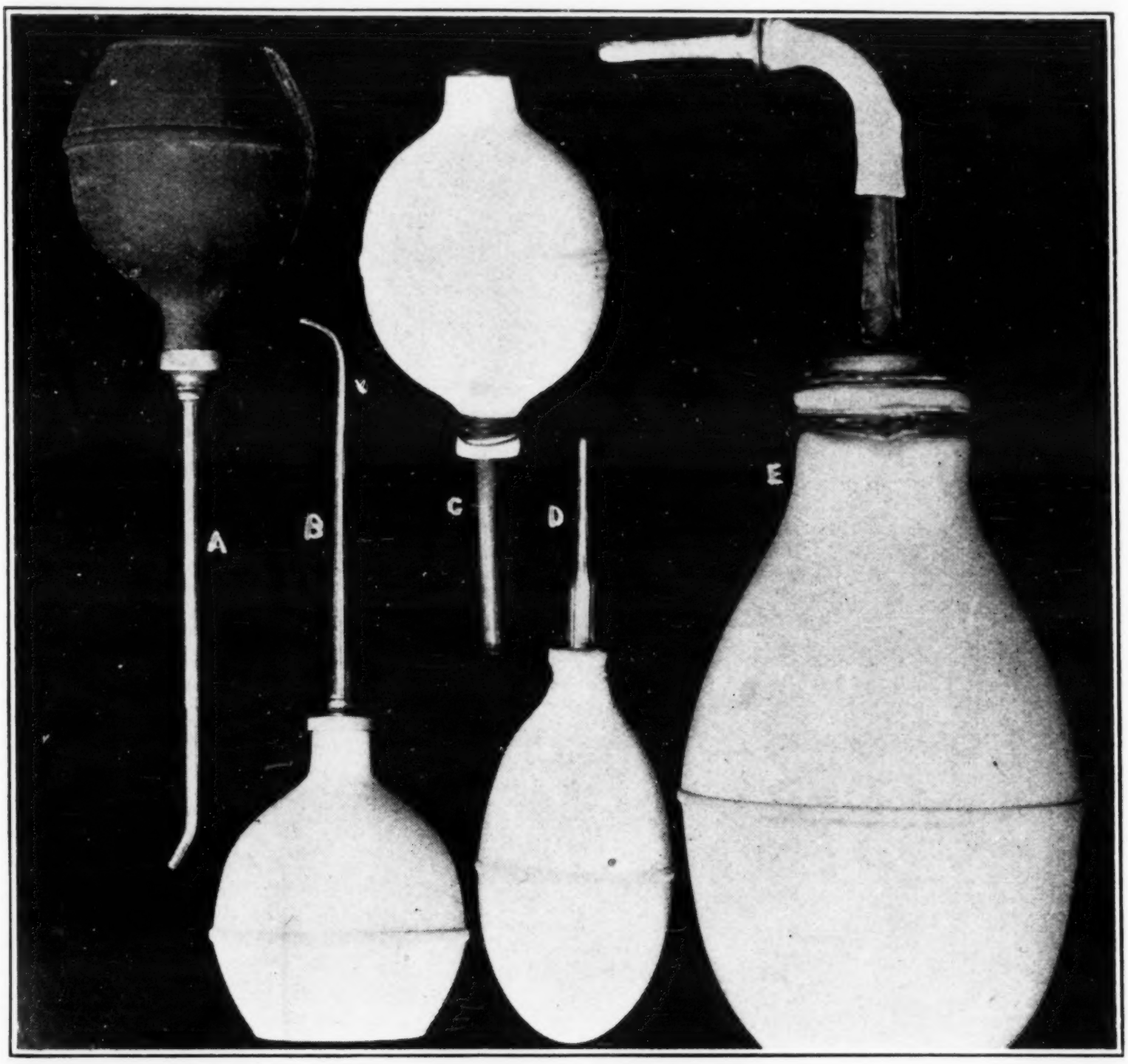

FIG. 5.—DEVICES USED IN DEPOLLINATING FLOWERS.

but seldom touching it, but even while the pollen touches the stigma while the sexual column is unsprung it is incompetent to perform the processes of pollination and fertilization, because in order to perform these missions the pollen must first be imbedded in the pulpy tissue of the stigma. Therefore the operator must strive to remove the pollen from and around the exploded anthers, and in some cases, from

and around and over the stigma without injuring any part of the pistil. This seems impossible, but by a little delicate yet withal easy manipulation every grain of pollen can be removed without injuring any part of the delicate organisms of the flower in the very least.

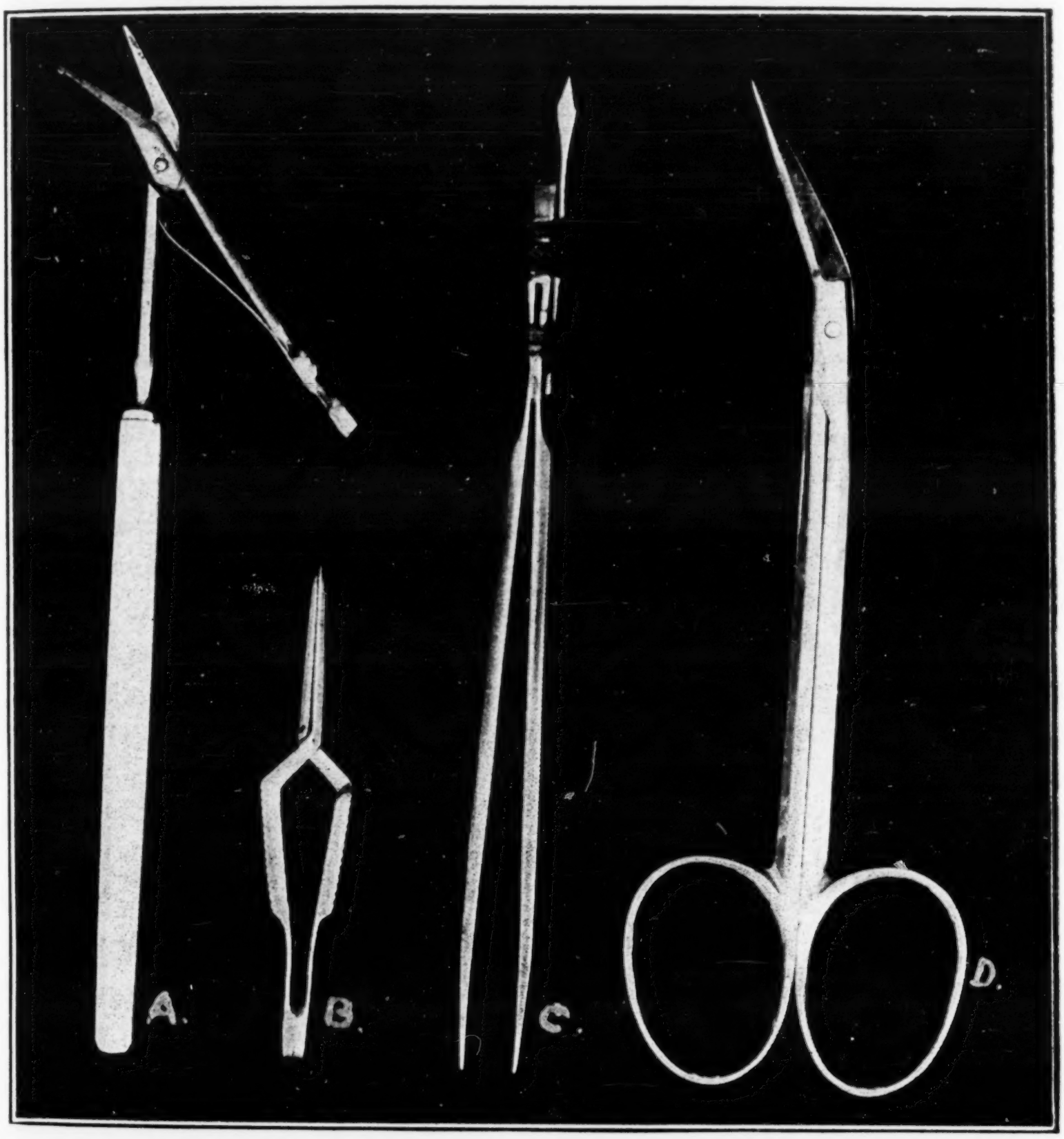

FIG. 6.—TOOLS USED IN CROSSING FLOWERS.

The first part of the operation consists in springing or tripping the sexual column, but instead of allowing it to trip on the banner, as shown in Fig. 3, B, allow it to trip very gradually on the pointed half of an ordinary small pin (Fig. 3, C) half an inch or more in length. The tripping can be accomplished very readily by placing

the piece of pin at the base of keel immediately opposite the base of the banner. Be certain that in placing the pin the blunt end is held by the fingers as this will facilitate withdrawal after pollination. Press the piece of pin against the suture of the keel, drawing it gently upward until the sexual column appears, it is thus intercepted in its ascent on the awaiting banner. Gradually allow the pin supporting the sexual column to come toward the banner and ultimately to rest upon it. (Fig. 3, C.) It will then be seen that the end of the column consisting of anther cases, pollen, and stigma is entirely free from contact with the banner. This provides the opportunity for depollination, which is accomplished with the aid of a tiny jet of water playing on and around the stigma for a few seconds. Every grain of pollen may be washed from and around the stigma in eight or ten seconds. (Fig. 4, E, F, and Fig. 3, D.) After this operation the moisture around the stigma is removed with a small piece of blotting paper applied edgewise.

While the sexual column is still resting on the pin supported in this position by the banner, the stigma must be pollinated (Fig. 3, E). If the pollen is not very plentiful it may be applied to the stigma with the aid of the flattened pin shown in Fig. 6, C, but if there is an abundance of pollen the sexual columns of the flowers of the male parent should be tripped into a watch glass and the pollen applied copiously to the stigma with the aid of a camel's hair brush moistened in a weak syrup of sugar and water, just thick enough to cause the hairs to stick together when drawn between the thumb and forefinger. When pollinated the flower is held gently but firmly between the thumb and forefinger and the pin withdrawn allowing the sexual column with the pollinated stigma to assume its natural position on the banner. (Fig. 3, F.) This action will cause the pollen grains to become imbedded in the soft tissue of the stigma.

THE ARMY HORSE.

CARLOS GUERRERO.

[*Published also by the Agricultural Association (Liga Agraria) of Buenos Aires.*]

Through the courtesy of the Minister of Agriculture of Germany, I was enabled to make an advantageous visit to the Imperial Stud-farm of Trakehnen, where I was cordially received by Baron

von Oettingen, the head manager, and his distinguished wife. The Baron himself accompanied me on my visit to the different premises of the stud-farm.

Trakehnen is situated in the northern part of the German Empire, near Russia, where the winters are cold and severe. On my way thither, the fields I could see from the car window were barren and sandy, but, nevertheless, one admires the constant efforts of man in laboring to make them productive. The Trakehnen stud-farm is, of itself, a village of considerable size, having a hotel for visitors, six schools, a pharmacy, an infirmary, and well built houses occupied by the employees of the stud-farm and their families. Commodious stables have been erected.

The Trakehnen stud-farm, which comprises a tract of land of about 10,855 acres, was founded in 1732. In winter this area is covered with snow. About half of it is used for the cultivation of hay-producing grasses, including alfalfa, which, notwithstanding the cold, grows luxuriantly. The other half of the property contains the buildings, and fields in which to pasture the horses in summer during the day, although at night they are always housed in stables, where they are fed alfalfa and oats. The farm is divided into twelve lots.

Under the management of Baron von Oettingen, are the following employees: A head veterinarian, with 2 assistants; a director of cultivation, with 4 inspectors; a cashier; a secretary; 3 clerks; a store superintendent; an architect; a physician, with a nurse and an apothecary; 11 school teachers; 11 overseers, with 12 assistants; 100 stable grooms, with 50 boy groom apprentices; 30 workmen; 15 store workmen; 3 wood choppers; 12 laborers; 55 plowmen; 12 night watchmen; from 15 to 70 day laborers; and 477 persons engaged in gardening and other occupations. These employees, together with their families, make a population of 2,600 souls. All live comfortably, each group of houses having its private orchard for the cultivation of fruits and vegetables for the use of the employees.

The duty of this large force is to care for 1,747 head of horses—the total number now at the Trakehnen stud-farm—and the oxen required for the work connected therewith. One can easily imagine the great cost to Germany of each horse raised on this stud-farm.

The aim of this large station is the improvement and breeding of military horses, and to supply horses for the Imperial House.

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From Trakehnen, also, are chosen annually 70 stallions without defects, for service at the different breeding stations of Germany. If the commission which inspects the stallions finds defective ones, these are castrated, and in April and September of each year, are sold on the premises at Trakehnen for sums varying from 1,000 to 4,000 marks ($250 to $1,000). The mares are treated in the same manner as the horses.

The Trakehnen stud-farm has 21 stallions, 13 of which are thoroughbred, 1 an Anglo-Arab, and 7 half bloods born in Trakehnen, but the latter, after undergoing continual cross-breeding with thoroughbreds, may be practically considered pure race horses.

The best thoroughbred stallion is "Red Prince," 20 years old, of a chestnut color, and born in Ireland. The thoroughbred stallion "Shilfa" has recently been purchased. Among the other race horses, I saw the stallion "Americus," a bay horse born in the United States, in 1892, and sired by the Emperor of Norfolk; "Aghan," a chestnut-colored horse, born in France in 1892, and sired by Flying Fox; "Pomp," born in Graditz in 1897, and sired by Chamont; and "Gordon," a bay horse, born in Russia in 1901, and sired by Gayarre.

Of the half bloods, the preference is given to the beautiful chestnut-colored stallion "Morgenstrahl," born in Trakehnen in 1896, and sired by Bue Bood, the favorite horse of the Kaiser, who always inquires concerning it. Another good horse is "Polarsbrum," of a black color, born in Trakehnen in 1900 and gotten by Optimus. I saw only one Anglo-Arab stallion, named "Nana Sakit," born in France from Rosteted and Mamir, the latter sired by Alger. The colts gotten by "Nana Sakit" are the handsomest on the stud-farm.

The brood mares are distributed into five lots of from 60 to 90 each. The group I liked best consisted of bay mares, and after that the chestnut-colored mares, some of which are very beautiful. There is a collection of black mares from which the horses for the carriage of the Kaiser are taken, but this group is not so good, as it is extremely difficult to find a thoroughbred black stallion without white marks.

When a year old the colts are separated from the mares, and treated like the rest of the horses, grazing in the pastures in summer during the day, and housed at night in the stables where they are given alfalfa and six pounds of oats.

Each lot of three stallions has its attractive pavilion, separated by paddocks in such a way that they can see each other without fighting.

The horses raised at Trakehnen are of the type of the early hunter. They are large horses with good-sized bones and strong muscles, capable of carrying considerable weight, and are handsome, impetuous, fast runners, and excellent for the steeple chase. They make a nice display in official parades, but are delicate and require much attention.

These horses, methodically fed on selected grains and grasses, brought up under shelter with great care, reared on soil prepared with loose sand so as to be soft to the tread, and unaccustomed to being galloped over bad roads, are these the horses required to withstand the hardships of a cruel war? The nation never knows where its military horses will be sent, whether over the well-kept roads of Europe, the rough steppes of Russia, the hot, dry and sandy deserts of Africa, into marshes or over rocky mountains, and perhaps to places where they will suffer thirst, be compelled to search for their own food, to obtain sustenance and strength from coarse and slightly nutritious grasses, and be compelled to endure all kinds of weather.

In Europe the test of the endurance of horses is made on good roads, and at the relay stations grooms are in waiting to refresh and feed them. They are never taken over rough or hard roads, nor are they permitted to suffer privations. Military horses should be prepared for war, brought up accustomed to harships, and of sufficient resisting force to stand long journeys.

With the exception of Russia, Hungary, and European Turkey, none of the countries of Europe, I think, can produce genuine military horses, and should, therefore, have breeding stations in North or South America, Asia, South Africa, or Australia, where horses of the kind required may be raised at a low cost. Countries like the United States, South Africa, Argentina, and Canada, that could raise an ideal type of military horses, having in view a quick transformation and despising the herds of horses already acclimatized, have spoiled them with heterogeneous crosses. The United States, for instance, is losing its good American Morgan breed, and the Government has done nothing to improve the bronco pony. The countries just mentioned have attempted to evolve military horses by means of race horses—a breed that is degenerating, because such horses are run too young,

before the skeleton has solidified; because, for gambling purposes, great velocity for short distances is the great object sought; and because they are pampered, ignoring the fact that military horses can not be treated in this way. The only thoroughbreds that might sometimes be useful in improving our light-weight horses are those with good lungs, strong, able to endure long journeys, and solidly built like "Red Prince," for instance, but such horses are scarce.

At Bloemfontein last June, the Governor of the Colony sent a number of well known experts to buy fine horses to the amount of £10,000, which parliament had provided for that purpose. Mr. Morgan, one of the experts for the purchase of the horses, bought 12 stallions and 6 mares, which he has already sent to Durban. Eight of the stallions are thoroughbreds, and four are coach horses, one of which is from Oldenburg, Germany. How soon the Boers have forgotten the good services their hardy basuto ponies rendered during the last war! The Japanese Government is also buying horses in England and paying very high prices for them.

In Argentina, with few exceptions, we have neglected the Argentine creole, or native horse—an excellent basis on which to found the military horse, and out of which, with but little trouble, a useful horse could have been developed, suitable for travel through marshes and over rough roads, having good health, hardihood, and endurance, acquired by several centuries of exposure to inclement weather. Nearly all these qualities have been lost, owing to the influence of sport, and the desire to secure beauty of form and action. The best mares from Montes Grandes were converted into oil in the factories, and the remainder of the Argentine herds have acquired many of the faults of the European breeds. A proof of the faults of European horses is shown at Trakehnen, where, in spite of the yearly selection of horses and mares, hereditary defects resulting from artificial breeding can not be eliminated.

When this happens in Germany, where so much care is taken, what will be the result in other countries where less attention is given to breeding, and where so many defective stallions have been imported for profit and commercial purposes only, the Government having had no control nor taken any steps to avoid the reproduction of these defects?

The Minister of Agriculture of Argentina should look after this branch of natural wealth, and endeavor to improve what is left of the

creole or native breed, doing all in his power to revive and preserve the good qualities of these excellent horses, so necessary for the defense of the country in time of war. As a matter of patriotism, the ranchmen of the Republic ought to cooperate to this end, never using stallions that have not been examined and certified to by a veterinarian as being in proper condition. Expert zoologists should also be consulted as to the formation of the breeds, such experts to be provided by the Government to horse-breeders who require their services.

The Barbary tribes, known from time immemorial as thieves and adventurers, and whose existence depends on their excellent horses, have maintained a pure breed, free from admixtures of foreign blood. Turkey, which has but slightly mixed its horses with those of other nations, has at its command fine military horses, like those of the Barbary tribes, who have European cavalry and horses for the artillery stationed in the province of Vilayet.

The artificial European horse is the product of an advanced civilization, unsuited to the hardships and cruelties of war, and the savagery and barbarity of warlike peoples, but war requires a horse that appears to be rough and savage like war itself.

In our country (Argentina) are encountered the most expert horsemen in the world, the best fields, excellent stud-farms on which to breed the most desirable military horses, as efficient in charges of cavalry as they are in cutting off the retreat of an enemy. Moreover, we have a fine military school, and all these elements contribute to the gaining of the victory.

If the earlier ranchmen of our country neglected the improvement of the native stud-farms, it was because of former continual civil wars and the disturbed condition of the country in epochs that have happily passed forever; but the Government as well as the revolutionists had at their disposal the best of horses. In the revolution of 1874, from the ranch called "Laguna de Juancho," which was then under my charge, the revolutionists took 1500 horses of the noted breed known as "Los Montes Grandes," the property of my father. The stud-farm of "Los Montes Grandes," which embraced the district of Twyu and part of that of Ajó, owing to the excellent quality of its fields and the shelter of its woods, without doubt contained the best native horses in America, stout, well proportioned, and spirited.

In 1873 I began on the "Laguna de Juancho" ranch, to improve the creole or native horses by selecting the best mares from a herd of 12,000 belonging to that ranch, but owing to circumstances beyond my control—I being at the time in Europe—all of the horses were sold, and the result of twelve years of improvement was lost thereby, a fact which I very much deplore. At the same time, on another ranch belonging to my father, I made, like many stockmen of that day, many errors in the breeding of horses, by interbreeding with Clydesdales and crossing the native mares with race horses; but I learned, in time, that for saddle and carriage horses I ought to avoid crossing with heavy draft animals.

MAKING AN ARGENTINA MORGAN BREED.

I separated the mares that had only been crossed with race horses, quadroons, half bloods, and some native mares, and crossed them—about 25 years ago—with a Morgan and Arab stallion, obtained from Mr. Vincente L. Casares, called Huilibi, and whose sire was pure Morgan and was called "Lion," imported from the United States, and whose dam was the half-blood hunter mare "Victoria," sired by a beautiful Arab stallion from the Chiarini circus. Upon this basis I continued crossing in and in, obtaining uniformity in breeds and an excellent horse for service. It may be said that I have formed a new breed of horses in the country, different from other saddle and carriage horses, and of a type and condition similar to the Morgan.

Acknowledgment must be made to Mr. Casares, who by importing a Morgan stallion, rendered a great service to his country, inasmuch as "Lion" was the stallion used in founding the best breed of horses for general use.

The native or creole horses of America were not the originators of a pure type of Arab or Barbary horses, like those possessed by the Moors. These came, undoubtedly, from the Spanish horse, which had already commenced the crossing process at the time of the discovery of America. The Spaniards of that age, after the expulsion of the Moors, endeavored to destroy all signs of Mussulman dominion. Because of the weighty armor of horse and rider, heavier and broader horses were required, and a cross was made with the German horse. If anything is still left of the Moorish horse in Europe, it may be found in Portugal, especially on the royal stud-farms of the House of Braganza.

The history of the crossing of the Spanish horse and its change of race, may be studied in the Museum of Paintings at Madrid, from the fifteenth to the eighteenth centuries, on the pictures of Berrugete, Rizzi, Bartolomé, Gonzalez, Paret, and Goya.

I have observed that the equestrian pictures painted by Bartolomé Gonzalez, such as the horse of Isabel of Bourbon, that of Margaret of Austria, compared with the vicious-faced, chestnut-colored horse, with four white legs, of Prince Baltazar, and that of the Count and Duke of Olivares, and other horses painted by Velasquez, resemble each other greatly, inasmuch as they have long manes, are corpulent, have broad breasts and rumps, large heads, bright eyes, short and strong necks, and short fore and hind legs. These horses, especially the chestnut-blossom horse of Isabel of Bourbon, with its noble mien, makes me think of the type of horse of "Montes Grandes."

Horses on later paintings, that is to say, the horse of the royal consorts of Paret, like the horse of Francisco de Palafrox and Soler, Duke of Zaragoza, that of Charles IV, and other paintings by Goya, are horses with oval sheep-shaped heads represented by two painters, and proof that at the end of the eighteenth century, the type of the Andalusian horse was of the Germanic race, all of which is well established. I presume that the Emperor, Charles V, of Germany, and Charles I of Spain, and the Emperors of the House of Austria who succeeded him, influenced the change of race of the Spanish horse. It is a human weakness never to be satisfied with the good that one has.

For some years I have had on one of my ranches a herd of thoroughbred mares, running with a stallion of pure blood in complete liberty, and in good pasturage throughout the entire year, for the purpose of determining the result of their progeny begotten under natural conditions, without other feed than the grass they are able to obtain in the inclosure.

The virgin fields of Argentina have been plowed by our native horses which opened the furrows for the production of our wonderful riches of cereal wealth. With solely these rough and strong native horses have the fields, scant in nutritious grasses, been transformed into meadows of alfalfa and pastures of succulent and tender graminaceous plants, suitable for feed for all kinds of stock, and capable of fattening it to such an extarordinary degree as to preclude the fear of competition from any part of the world.

The Indian chiefs commanding the troops that invaded Buenos Aires had excellent native horses for use in their murderous incursions and continual wars of plunder and rapine waged against the Christians. Sometimes, during these invasions, the officers who guarded the frontiers were accustomed to report to the Government that, owing to the superiority of the Indian mounts, they could not overtake the Indian bands and wrest from them the fruits of their raids. These savages, whose principal element of strength consisted in their steeds, had excellent horses at their command, since, with their habitual savagery, they inured their horses to numerous tests of brutal resistance. The Indians, in determining whether the horses which they stole from the Christians were good or not, used to race them over rough and marshy fields, urging them on by pricking them with the lance and shouting at the top of their voices. The horses that showed sufficient spirit and resistance in this barbarous test were retained captive, the weak and spiritless ones being set free or despatched with the lance.

How different are the delicate and humane tests of resistance now employed by civilized nations in time of peace for selecting the best military horses, in comparison with the test just described, not taking into consideration the cruelty of actual war. If the different methods are compared—those of civilization with those of the barbarous Indians—some deductions unfavorable to the former may be drawn when it is remembered that the soldier and his horse, in time of war, form together an instrument of destruction and death.

The Ohio Corn Breeders Association is rapidly organizing branch associations in every county in that State. If in ten years this association can prove that under the leadership of Messrs. Williams and Goddard they shall have increased the production of corn from five to ten bushels per acre throughout the entire State, all States and counties in the Union will want to follow their methods. These two men mentioned have followed up the courage of their convictions in a masterful way. Corn, the great national crop, has as much right to be the subject of brilliant achievements as politics or war.

IMPERFECTION OF DOMINANCE.

C. B. DAVENPORT, *Cold Spring Harbor, N. Y.*

The opposition to mendelian principles of heredity is gradually vanishing in the face of facts. The principle of *segregation of characters*, according to which dissimilar parental characters do not blend in the progeny but come out intact as in the grandparents, is recognized as widespread if not universal. But concerning *dominance* there still remains much skepticism without and much confusion within the fold.

What is dominance? Bateson, in his first statements of Mendel's doctrine (in 1902), says (page 9): "In the case of each pair of characters there is thus one which in the first cross prevails to the exclusion of the other. This prevailing character Mendel calls the *dominant* character." We have progressed far in the last seven years and now we think of dominance as occurring when one parent has a characteristic that the other lacks. Under these circumstances the offspring possess the character—that is the whole story and it seems simple enough.

Two complications must, however, be considered. It appears that in certain characters which show a great variety of *grades*, as pigment does in human hair, the more advanced grade, e. g. the heavier pigmentation, dominates over the lesser grade. This would seem to indicate either that a low grade of a character may act toward a high grade as absence towards presence, or else that hair, despite its apparent continuity, really consists of a multitude of discontinuous units; and that a lower grade means absence of a unit present in a higher grade.

The second complication is the fact of imperfect dominance. Even Mendel recognized that dominance is not always perfect in sweetpeas, for the hybrids between white-flowered and purple-red-flowered peas have flowers less intensely colored than the darker parent. Correns, in 1900, showed that in a certain set of crosses between good species the hybrids had the characters as in both parents, only reduced in varying degrees. Bateson and Saunders, in 1902, found that the "intensity of the dominant character (comb and extra toe) is often considerably reduced." Correns, in 1905, stated that there was known a complete series of cases at one extreme of which one "allelomorph" completely hindered the appearance of the other, while at the opposite

end of the series the hybrid character showed an intermediate condition, both "allelomorphs" appearing with equal strength. In my study of poultry such a series is striking. When the median comb is mated with no-median the median comb appears in the offspring but reduced in length between 30 and 100 per cent. Extra toe mated with normal gives extra toe in only 73 per cent. of the offspring. Syndactylism is dominant over its absence, but no syndactyl offspring were observed in the first hybrid generation; nevertheless two syndactyl parents yield about 56 per cent syndactyl offspring. Rumplessness is dominant. But a tailless cock mated to tailed hens produced no rumpless offspring; neither when mated to his daughters did any tailless appear, but the reduced "pope's nose" and shortened back showed that there was an imperfect modification. However, another strain has given results more in accord with expectation. Finally, winglessness appears not to be inherited at all, but the hypothesis is tenable that winglessness is an imperfectly dominant character. Thus the series of potency in dominance is complete.

The failure fully to recognize and accept the consequences of imperfection of dominance has led to misunderstandings and to unnecessary subsidiary hypotheses. The Mendelians, knowing the fact of imperfect dominance, have placed too much stress on dominance and recessiveness, and so laid themselves open to just criticism by their opponents. Dominance is a corollary of segregation and its discovery marks a great step in advance, but its variation in degree must be constantly recognized and insisted upon. The consequences are most important. First, because of imperfect dominance, and the accompanying diluted nature of the determiner in the heterozygotes, the character may appear in reduced amount and permit a hypostatic quality to appear. Thus poultry with deep black plumage mated with albinos show in part the Jungle fowl plumage in the offspring that is covered over by the black pigment in the dark parent. Thus a new character is revealed by the heterozygote.

Secondly, the weakened character may be retarded in development so that it fails to appear at the normal period but develops later. Thus Lang found hybrids between red and non-red snails to be at first non-red but finally red. Some authors have spoken of this as *reversal of dominance,* and even Bateson uses this terminology in his latest book. But this is obviously an unfortunate term if dominance means the presence of a quality. For, a given quality, that is due

to the absence of a factor, like blue iris color, cannot be at one time recessive and at another dominant. If a blue iris appears where brown is expected, the clear reason is that brown pigment has merely failed to develop and is potentially present. A similar case occurs in hybrids between albino and some buff birds; the chicks have a pure white down, only later acquiring the black and buff of the adult plumage. Albinism is here not momentarily dominant, but merely pigmentation, owing to the weakened stimulus to its production in the heterozygote, is delayed in development.

Not in heterozygotes only but even in homozygotes the character may fail to develop. Extra toe is dominant in certain fowls. Even in pure-bred fowls that are certainly homozygous dominants, two or three per cent of the offspring may fail to develop the extra toe. Evidently, for some reason, the proper internal stimulus is lacking to complete the development of the toe in these few individuals.

In many cases, Shull has stated, imperfect dominance may make it impossible to tell which character is dominant, so that an apparent recessive "presence" of a character may be an imperfectly dominant "presence." But I cannot follow him entirely. Between imperfect dominance and recessiveness there is clear distinction—two perfect and imperfect dominants alike may throw some recessives; but two homozygous recessive parents can throw no dominants; where neither parent possesses a character in its germ plasm their progeny will not have the character. Some families of two recessive parents will, then, throw only offspring of one kind; such are homozygous parents and their offspring are pure recessives.

Many cases of apparent blending are due to imperfect dominance. Thus I recognize 10 grades of booting or foot-feathering of poultry and one of no boot. If a booted be mated to a non-booted the grades in the offspring run from 0 to 8; it is impossible to say whether booting or clear shanks is dominant. In F-2, booted and clean shanks appear again, with boot of some grade in a large majority. *All* of the extracted clear-shanked mated together produce some booted birds and some of the booted, mated inter se, may produce clear-shanked offspring; such parents are clearly heterozygotes with arrested dominance. But, on the other hand, some of the booted, bred inter se, produce only booted offspring; such are clearly extracted recessives. I have a set of such matings yielding 287 offspring, 100 per cent booted. My best extracted homozygous dominant

clean-shanks produce only 90 per cent of offspring with clean shanks. Presence × presence of a character may give *absence* through failure of the character to develop, but absence × absence of a character can give no trace of the character.

Finally, dominance may be so imperfect that the dominant character fails completely to develop in the heterozygote and develops only imperfectly or sporadically in the homozygote. This is apparently the explanation of many cases where a character seems not to be inherited. The character has perhaps arisen once as a sport but cannot be propagated. It is probable in such cases that the internal stimulus to development of the organ is too weak. This case is illustrated by a rumpless cock which, crossed with tailed birds, produced only tailed offspring. These offspring mated among themselves and with their father produced no tailless progeny. Nevertheless a disturbance in the germ plasm was indicated by the small "pope's nose" that carries the tail feathers and by shortened, bent backs. These tailed heterozygotes mated to a tailless son of the first cock produced a large proportion of tailless birds. Indeed, taillessness proves to be dominant, but its determiner in the germ plasm is very feeble.

This study, then, leads to the conclusion that alongside of dominance we must place an important modifying factor—the factor of the strength or potency of the representative of the given character in the germ plasm. This is clearly a very variable quality. If it is very potent we get a typically mendelian result; but if it is weak, we will have imperfect dominance or failure to develop altogether.

[Presented by the Committee on Theoretical Research.]

LEGISLATION AFFECTING THE RAISING OF DEER AND ELK FOR PROFIT.

D. E. LANTZ, *Chairman.*

Your committee has little that is new to report at this time. A general interest in the subject of raising deer and elk for profit has been aroused during the present year, and many inquiries about the management of the animals have been answered by the chairman of the committee. The chief difficulty has been to obtain information concerning breeding stock that may be for sale. It has been developed

that few breeders of deer are prepared to capture and crate their stock so as to be able to deliver the animals to would-be purchasers. As a result, prices have been high and offerings so few that many persons who wished to start in the business have been compelled to defer it for the present.

Considerable progress was made during the year in securing legislation more favorable to the breeders of large game animals, and the status of private game preserves has been more definitely fixed in several States. The experience of those who have worked to secure legislative recognition of the rights of private ownership in deer is encouraging, and shows that whenever the real demands of breeders are properly presented before legislative bodies, the lawmakers will respond with just enactments.

A review of the legislation which recognizes private rights in domesticated big game is here given. It will be noticed that much of it is recent.

ARKANSAS.—The act of February 23, 1907, is still in force. It provides that "nothing in this act shall be so construed as to prevent any person or persons from having in their possession, or buying, or selling, or shipping, or any railroad from receiving for transportation any deer or fawn when such deer or fawn is raised in captivity for domestic purposes and is accompanied by an affidavit from the owner to this effect."

COLORADO.—A system of licensing private parks and fish preserves is provided. No one may maintain such preserve without a license. Owners of licensed private preserves are permitted to sell and ship deer or other quadrupeds, if the carcasses or live animals are accompanied by proper invoice and a permit from the State Game and Fish Commissioner. A fee is charged for the license and for each animal shipped by permit. About a dozen deer and elk parks are now licensed under this law.

FLORIDA.—An act was passed this year to encourage the establishment and maintenance of unenclosed game preserves by protecting such preserves from trespass of hunters. The preserves must be carefully posted, are limited to 640 acres in area, and are subject to all laws of the State regulating the hunting of game. The game with which they are stocked is absolutely protected for a period of three years.

MICHIGAN.—The Legislature of Michigan also passed a law making it illegal to capture or destroy deer kept within or that have escaped from a private enclosure.

KENTUCKY.—Kentucky for many years has had a similar law protecting game in parks from poaching and trespass.

IOWA.—Iowa has a statute making it unlawful for any person other than the owner or person authorized by the owner to kill, maim, trap, or in any way injure or capture any deer, elk, or goat, except when distrained as provided by law. As Iowa has no wild deer except a few that have escaped from a private herd, the sale of venison from preserves is not prohibited.

ILLINOIS.—The provision of the law of 1907 allowing persons who raise deer within an enclosure to kill and sell the same at any time, in the same manner as other domestic animals, has now been amended to permit such sale for four months, from October 1 to February 1, this being the open season for the sale of game shipped from without the State.

INDIANA.—The law forbidding the killing of certain game has the following clause: "Provided, that the provisions of this section shall not apply to any person or persons owning or having under his domain or control any deer, buck, doe, or fawn bred or raised in any deer park." Transportation of deer outside the State is prohibited.

MISSOURI.—The former provision of law that deer or elk from private preserves must be accompanied by a tag furnished by the local game warden identifying the property has been replaced by a new proviso, saying, merely, "Nothing in this act shall be construed to prevent the shipment of deer or elk alive or dead from private preserves when such deer or elk are raised in captivity."

OKLAHOMA.—A section of the game law of 1909 permits the sale of domesticated game animals and birds within the State. The law says nothing on the subject of their export.

NEW HAMPSHIRE.—The Blue Mountain Forest Association may kill elk, deer, and moose within the confines of its game preserve and transport them outside the State at any time when accompanied by a certificate from the State Fish and Game Commission. This seems to be regarded somewhat in the nature of a private vested right. The legality of restricting such a privilege might well be questioned by any other association possessing a private park in the State.

NORTH CAROLINA.—Twenty-two counties of this State have laws, passed in 1907 and 1909, permitting the owner and keeper of an enclosed game preserve, who raises deer for use or sale, to kill, sell, or use those kept in said enclosures.

MASSACHUSETTS.—The owner of tame deer may kill or sell the animals kept on his own grounds.
—Chapter 307, Laws of 1907.

During the past year three neighboring States have enacted laws that are in some respects similar to the Minnesota provision for private parks. They differ from it in requiring no fees for the permit to establish a park. For purposes of comparison the provisions made in this group of four northwestern States are placed consecutively.

MINNESOTA.—Persons who desire to domesticate deer, moose, elk, or caribou may secure a permit to do so from the State Board of Game and Fish Commissioners by paying a fee of fifty cents for each animal held in captivity and a like fee for each animal added later by natural increase or otherwise. An annual report from the breeder is required. The animals kept in captivity may be sold or shipped within or without the State upon receiving written permission to do so from the Commission.

NORTH DAKOTA.—The State Game and Fish Board of Control is authorized to issue permits to breed or domesticate any of the game birds or animals mentioned in the law. An annual report is required from persons holding such permits, and they may sell or ship game within or without the State upon receipt of written permission to do so from the board. —Chapter 128, Laws of 1909.

SOUTH DAKOTA.—The State Game Warden may issue permits to breed or domesticate deer, moose, elk, caribou, buffalo, or game birds. Annual reports are required from holders of such permits. On receipt of written permission from the game warden any of the animals held in possession in private preserves may be sold or shipped within or without the State.
—Chapter 240, Laws of 1909.

WISCONSIN.—The Fish and Game Warden may issue permits to breed or domesticate deer, moose, elk or caribou. A system of marking the animals in preserves established under permits is authorized, and such animals may be sold or shipped within or without

the State upon receipt of written permission to do so from the State Game and Fish Warden. A tag identifying the animal by number must accompany every carcass or part of carcass shipped or exposed for sale.

—Chapter 525, Laws of 1909.

PENNSYLVANIA.—A marked change of sentiment is shown in recent legislation as to private preserves in Pennsylvania. Until the enactment of the present law persons who had game preserves were unable to use them except under the provisions of the general game law of the State; that is, the owner of the preserve or each member of an association owning it could kill one male deer in a season. Deer could be sold and shipped alive within the State for propagating purposes only.

The law of 1909 provides that the State Board of Game Commissioners may issue propagating certificates to individuals or associations that desire to raise deer or other large game animals. The land must be enclosed by an approved wire fence not less than 8 feet high. All wild deer must first be driven from the land under direction of a representative of the State Board of Game Commissioners. A careful account of all game raised or brought to the preserve must be kept and reports of any increase made annually to the board. Deer may be killed inside the preserve and shipped only during the open season and for 30 days thereafter. They may be shipped alive for propagating purposes at any time. Each deer or carcass of deer shipped from the preserve must bear a tag furnished by the State board, by which it may be identified at any time.

—Act No. 204, 1909.

NEW YORK.—Until the amendment secured during the present year, the game law of New York did not permit common carriers to transport a deer carcass unless it was accompanied by the owner, who had killed it in the open season. Charles F. Dieterich, owner of a private herd of deer in Dutchess county, had been accustomed to kill off some of the bucks each year and market the venison in New York City. Under the old law the American Express Company refused to receive and transport this venison. Mr. Dieterich applied for a temporary injunction against the president of the Express Co., James C. Fargo, claiming that the law prohibiting transportation did not apply to domesticated deer. The Supreme Court of New York County, in December, 1906, decided in favor of Dieterich, but the

Express Company appealed and the decision was reversed by the Appellate Division of the Supreme Court of the State, May 10, 1907. Dieterich then carried the case to the New York Court of Appeals, which finally, February 23, 1909, reversed the decision of the Appellate court, holding that the law concerning transportation of venison did not apply to that from domesticated deer bred in confinement, and that the owner of such deer is not restricted as to the number he may kill and ship during the open season.

To market his deer in 1908, while his final appeal was pending, Mr. Dieterich resorted to the novel expedient of inviting a number of his friends from the city to visit his country preserve, he having furnished them transportation. Each man shot a deer and accompanied the carcass to market, as required by the law as then interpreted.

The law as recently amended by the State legislature permits deer to be sold during the open season, and moose, elk, caribou, and antelope from private parks to be sold during the same period. Common carriers may transport live animals into the State for breeding purposes. The section forbidding transportation of venison unaccompanied by the owner has been amended by the provision that it "shall not apply to domesticated deer propagated in wholly-enclosed deer parks, when shipments from such parks are accompanied by a permit issued by the forest, fish, and game commission under conditions prescribed by the commissioner."

From the above review, we gather that the statutes in 15 States now permit the sale of venison from private parks, either with or without restrictions of some sort. Four other States have specific laws to protect private game parks from poaching; but in most States the ordinary trespass laws accomplish the same purpose.

Besides this direct legislation on the subject of private deer parks, sale of venison from domesticated deer would be possible in a number of other States. A few, like Delaware, Kansas, and Ohio, have no mention of deer in their statutes, there being no wild deer to protect. A few others, like Nebraska, except from the provisions of the game law, all animals and birds "held by private ownership legally acquired." Just what rights private owners possess as to shipment and sale of venison is not always clear in the absence of specific legislation on the subject.

[Report of Committee on Breeding Wild Animals.]

VALUE OF WILD ANIMALS.

C. D. RICHARDSON, *West Brookfield, Mass.*

If thou art worn and hard beset
With sorrows that thou wouldst forget,
If thou wouldst read a lesson, that will keep
The heart from fainting, and the soul from sleep,
Go to the woods and hills! No tears
Dim the sweet look that Nature wears.

—*Longfellow.*

We as a people work too much and play too little. We are hurrying along to a nervous wreckage which is weakening to the country itself and which will in time reflect upon us as a people. To the over-wrought nerves nature ever offers a soothing balm. When the curtain of life hangs low and dark, go to the woods and learn nature's secret of how to live, for a day spent in the country gives a wealth of interests, a thorough relaxation of mind and body, and makes life seem more beautiful and rather more worth the living.

Those beautiful wooded dells should be the haunts of the wild creatures, as when first discovered by the white man. Too long they, with their wild life, have been given over to the pot hunter and to him who would despoil them of their true charm. There is a growing recognition that the strain of modern life can be best endured by often fleeing to the wilds, which calls at times to all, but louder to some than to others.

All over this great country of ours there are vast stretches of waste land, with their variety of woods, swamp, and hillside, which yield but little profit to the owner. Let us look a little into the future. Suppose we make something of this land, fence it in, reforest it, and stock it with game. It will require little care and the average farmer may realize from it more than he now does from his tilled acres. The fence problem is practically solved in the use of woven wire, and a large tract may be enclosed at a comparatively small expense.

The food problem, too, is a simple one, as grouse, pheasants, quail, etc., subsist almost wholly upon insects which if unchecked would destroy all vegetation, on noxious seeds, and on buds of unimportant trees, while the larger game animals, especially those of the deer family, feed almost wholly on twigs and leaves of vegetation which is of no real value, if not a menace to the farmer. In fact,

the finest grazing ground for such animals is an old brush pasture, in which the ordinary domestic animals would starve, but which furnishes to the wild creatures their most natural food.

The question of vermin—the fox, weasels, skunk, cat, etc., the natural enemies of the bird—must be considered and a systematic warfare waged against them. An English moor of from 100 to 500 acres often rents for 300 pounds ($1500) a season, just for the shooting privileges of the grouse alone. The increase in bird life on such a tract is simply enormous when the vermin is disposed of.

There is a growing demand for live game to supply zoological parks, and for game as food, at increasingly high prices. The revenue which may be derived from shooting privileges and from camping parties who would steal away from the busy mart to enjoy a season with nature, in all her fullness, may not be inconsiderable.

The national parks, whose value to the country cannot be over-estimated, are too far away for the average citizen to enjoy, but he may have that which will give much pleasure and profit nearer home. A tract of waste land of from 100 to 1000 acres may be obtained in almost any section of the country and especially in the hilly and mountainous regions, at a price within the reach of every alert farmer. The cost of fencing need not exceed $1 a rod for an 8-foot fence, and the game for stocking—birds and small game will rapidly multiply under protection—can be procured at a price no greater than that paid for domestic animals.

One of the secrets of the success of the English race is in the fact that they as a people have emphasized out-of-door life. The rugged physique and robust health of the average Englishman are due to the fact that he is able to dismiss all care and enjoy a day with rod or gun. His large landed estates together with the climatic conditions offer favorable opportunities for all out-door sports. While we believe that large landed estates are a menace to the best interests of any people, yet with our large acreage of waste land and democratic ideals there is no possible danger that we shall ever suffer by the establishment of game preserves in this country. These game preserves may not only be centers from which the surrounding covers will be stocked, but they may be object lessons in forestry, of which this country stands in vital need, to say nothing of making rural life more beautiful and attractive.

[Presented by the Committee on Breeding Wild Animals. D. E. LANTZ, Chairman.]

EXPERIENCE IN RAISING VIRGINIA DEER.

C. H. ROSEBERRY, *Stella, Mo.*

I know of no other branch of the live-stock industry that returns as great a profit in proportion to the time, labor, and capital invested as that of deer raising.

My experience is limited to the Virginia white-tailed deer *(Cariacus virginianus)* and covers a period of 19 years. Doubtless the raising of elk or wapiti would be equally profitable—perhaps more so where raised for venison, owing to the greater size.

A tract of 10, 20, or 40 acres of rough brush land, enclosed with a 6½ or 7 foot woven wire fence, with provisions for a constant supply of water, either natural or artificial, is the chief requisite. It is better if there be dense thickets of underbrush, coarse weeds, and trees of pin oak, white oak, pig hickory, chestnut, etc. The twigs, leaves, and mast of these afford an abundance of natural food as well as shelter and seclusion.

It is also desirable to have a plat of three or four acres of tillable land on which to sow rye or wheat for winter pasture.

As the underbrush is gradually killed out, as it will be as the herd increases in numbers, unless the range is quite extensive, white clover and orchard grass may be sown for summer forage.

In the latitude of southwestern Missouri, feeding is not necessary between April 1 and November 1. For the rest of the year a stack of cowpea or clover hay to which the deer have free access, supplemented by a light ration of corn and bran or other mill feed in severe weather, is sufficient.

Do not feed too heavily of shelled corn. If gorged with it the results are often fatal.

If it is desired to raise venison it is, of course, not necessary that the fawns be accustomed to handling while young in order to tame them. But if raised for sale as breeding stock, requiring that they be handled and shipped alive, it is necessary to take the fawns from the does when they are ten days old and raise them by hand on cow's milk.

This, of course, involves a great deal more trouble and expense than to let the fawn run with the doe; hence the price received for breeding stock is proportionately greater than that received for the

venison carcass. For example, a yearling dressed for market may weigh 60 pounds net, and could be profitably sold for 25 cents a pound, or $15; whereas the same raised by hand would be worth at least $30 for a buck, or $45 for a doe.

My method of raising by hand is as follows: A tract of 3 or 4 acres, free of underbrush, in which the fawns might hide, is fenced off from the main park. Early in May the does that are to drop fawns are confined in this small lot.

During fawning time the lot is carefully searched at intervals of two or three days, and when a fawn a day or two old is found it is at once tagged by tying about its neck a strip of cloth—red if it is a buck or white if it is a doe—and allowed to remain with the doe ten days, when it is taken from the park and confined in a 5-by-10-foot cage made of one-inch poultry netting, lined inside with cloth and bedded with clean straw. A 5-by-10 cage will accommodate 12 fawns. The bedding must be kept dry and frequently changed for cleanliness. The cloth lining is necessary to prevent injury. The youngster is exceedingly wild at first and dashes himself against the sides of the cage in frantic efforts to escape.

If allowed to remain longer than ten days with the doe, it is often impossible to capture the fawn except by a chase or by strategy. The latter consists in biding your time until the fawn is found lying beside a log, stump, or clump of bushes, when it is very stealthily approached from the leeward to within springing distance and pounced upon before it can get to its feet. When other methods of capture fail it may be run into a fish net in which it will become entangled.

The fawns remain in the cage for two weeks, during which time they learn to drink fresh milk from a bottle and become quite tame. They are then allowed the freedom of an enclosure 20 by 100 feet for two weeks longer, when they are given a still wider range. But they must not be returned to the park, else they will become wild again.

The adult Virginia buck, if raised by hand, often becomes vicious, especially during the rutting season, and should not be trusted until rendered comparatively harmless, either by sawing off his antlers an inch above the burr or by bolting a 1-by-4 hardwood board 3 feet long across the tips of his antlers. The wild bucks never lose their fear of man sufficiently to attack him.

I would not advise beginners with small means to go into the business of deer raising too heavily at first. It is better to begin on a small scale—say 10 acres and a herd of vigorous stock and let the business increase along with the increase of knowledge to be gained by experience.

Thousands of acres of rough land unsuited for cultivation that now brings its owner no returns for his investment may, by converting it into small deer farms, be made to yield the owners a handsome profit, as well as much pleasure.

[Presented by the Committee on Breeding Wild Animals. D. E. LANTZ, Chairman.]

POULTRY BREEDING IN SOUTH AUSTRALIA.

D. F. LAURIE, *Adelaide, South Australia.*

The history of poultry breeding in the State of South Australia dates back sixty or seventy years. Soon after the foundation of the (then) colony, and with some of the first settlers, there arrived pure-bred poultry brought from England. Regular exhibitions of poultry began about forty years ago, and progressed more or less until about twenty years ago when a strong movement took place and has since continued. Numerous direct importations from England have been made from time to time, but the adjoining States have been the chief source from which fresh blood has been drawn.

There have been and still are in Australia many ardent fanciers who do not begrudge the money necessary to secure noted English winners, but there is reason for believing that in the future our breeders will show less inclination to send to England for fresh blood and prominent winners except in certain breeds. The reason for this is that our breeders do not approve the type of many breeds now fashionable in England. As regards importations from America, Plymouth Rocks (barred, buff, and white) and the Wyandottes (partridge, white, silver-pencilled, and gold-laced) have been imported into the other States in considerable numbers, and selected draughts of the progeny resulting from these importations have been added to our flocks. The popular exhibition breeds at present are:—

Orpingtons, Black, Buff and White.

Wyandottes, Silver, White, Gold; and other varieties to a lesser degree.

Plymouth Rock, the American Barred.
Dorkings, Colored, and Silver-grey.
Faverolles.
Langshans.
Old English Game, Indian Game, British Game; Malays for which the State is famous.
Leghorns, White, Black, Brown, and Buff.
Minorcas, and a fair sprinkling of other light breeds.
Ducks: Pekin, Rouen, Aylesbury, and Indian Runner.

As regards breeding, the best efforts are centered in Orpingtons, Wyandottes, Rocks, Old English Games, and White Leghorns. We have numerous skilled breeders and exhibitors, and many of our best specimens are shown in excellent style.

COMMERCIAL POULTRY.

During recent years far more attention has been paid to utility or commercial breeds than to mere exhibition stock. This is due to the action of the State Government in fostering poultry breeding as a national industry. The commercial sections of our poultry shows appeal strongly to the utilitarian instincts of our poultry breeders.

The great help rendered by the press in devoting considerable space to matters of interest to poultry breeders and to the publication each week of the full results and progress of the laying competitions is assisting in educating our breeders and encouraging the novice.

WHAT OUR BREEDERS ARE DOING.

During the last ten years, or so, a number of our breeders have paid special attention to developing what are termed utility strains of various breeds. We here take quite a different view from that of the English breeders. There the culls of any breed are disposed of at low prices to serve at utility fowls. In South Australia we place such birds in their proper category: we call them culls, and consign them to the kitchen.

Our utility strains are bred as carefully as, and even more so in many respects than, our exhibition strains. The difference is this, our breeders select for the constant improvement of utility points in the first place, and while maintaining type, allow the less important

external characteristics to take a less prominent position. While this good work is going on with many breeds there is no doubt that main results are to be witnessed in the White Leghorn as developed for egg production.

HISTORY OF THE WHITE LEGHORN IN SOUTH AUSTRALIA.

As our White Leghorns have attracted world-wide attention to the excellent scores made by representative pens in public competition, and under strict official supervision, a brief history of their origin may be of interest. About twenty-five years ago several importations into Australia were made; the birds hailed from America. These birds were slightly larger and more robust than specimens imported a few years ago. It will be remembered that about this period the Leghorn was fairly popular in England, and the prevailing type as seen at shows did not differ materially from the originals which also came from America. It appears then that our first draughts of blood were of American origin, and, as far as I know, we never had the type known throughout Europe as the Italian fowl. Later on fresh additions were made from time to time and in every case from England. There, as we know, the breeders had resorted to crosses to increase the size, etc. Hens, as at first imported, weighed 3½ to 4½ pounds, while occasional hens among the later importations weighed 6, 7, or 8 pounds. The blend resulted in a rather large type, square and heavy. Seven or eight years ago fresh blood came from America to Australia; and of the strains imported those of Messrs. Van Dreser and Wyckoff were most favored although their lack of size, indifferent head points and evident want of stamina were viewed with suspicion. The introduction of this new draught of blood was productive of wonderful results, the strains "nicked" and the resulting fowl is as follows:

Size. Perhaps not more than half or three-quarters of a pound heavier on the average in both sexes as compared with the birds imported from America.

Type. Practically that of the American, retaining the good shoulder and length of leg, but deeper behind, thus showing capacity.

Stamina and General Appearance. Hardy, robust and bold. The head points are better developed, although kept in strict moderation. These birds are just as active, and on as fine lines as are their smaller

fragile-looking American relatives. The hens are smart, active, busy, scratching cacklers, and the male birds are as full of fire and life as could be wished; they are very game, not to say pugnacious.

HOW THEY ARE BRED.

The success of the fresh infusion of American blood as regards laying set the ball rolling, and the new type headed the list. Our leading breeders select vigorously and adopt what is known as "Line" or "Pedigree" breeding exclusively. As the pullets grow they are subjected to constant and vigorous culling, with the result that the final selection represents the judgment of that particular breeder.

Testing. While a few still adhere to the old method of trap nesting, the advanced breeders pen the pullets singly in small but convenient pens. Here they undergo the ordeal, the result of which decides whether or not they are to be retained as breeders. As a rule these pullets are not unduly forced, they are supplied with suitable foods in variety but are not pampered. Few breeders would attach much value to a pullet with a 200-egg score for the year; she must lay 220 to 240 to cause any enthusiasm, and above that yield she becomes precious. Those whose test is satisfactory are specially distinguished by leg bands and numbers, and particulars are carefully recorded.

The Male Bird. Our breeders attach as much importance to the ancestry of the cockerel as to that of the pullet. The selected stud bird has been, up to the present time, exemplifying the doctrine of the survival of the fittest. He has, with his mates, first of all to pass muster as to type, carriage, general style and vigor. After that he holds his own in the daily battles, who crows loudest and most frequently and shows his strength and vigor in every detail becomes the apple of the breeder's eye. His pedigree is accurately known, and much thought is given to the selection of his mates from among the best second-season tested females.

Some Additional Points. Our breeders know that mere selection based on individual egg production does not fulfill all requirements. In pedigree breeding, where you are endeavoring to concentrate all desirable points and characteristics, you must rigorously guard against the concentration of undesirable points. What are known as latent defects show themselves; we find reversion to some point or other which must be eliminated. Many a promising pullet is dis-

carded because she shows some weak point or undesirable character. Where it is necessary to graft on some desired point the process is slow and intricate. In improving the one point others must not be sacrificed, but to the patient and skilled breeders nothing is impossible.

CAN A HIGH AVERAGE BE MAINTAINED?

This question seems to trouble our friends over the water more than it does us. There is not the shadow of a doubt that the adoption of this method of rigorous selection and systematic pedigree breeding must result as follows:—

1. In the production of stud birds of great laying power.
2. In considerably raising the average egg production of any flocks of laying fowls so bred.
3. By this process alone can a high level of egg production be maintained.
4. The adoption of the methods indicated must result in the elimination of undesirable characteristics and hereditary tendencies, and finally result in robust constitution and ability to assimilate the food necessary for the production of large egg yields. Toughness of fibre and ability to stand the shock and strain of constant egg production can be acquired by each method alone. We read the opinions of those who follow sheep-like and we hear sometimes their sympathetic groans. Nevertheless the fact remains that the progeny of great layers, if thus selected, are vastly superior in constitution, fecundity, and general breeding powers to the half-wild farm hen. The whole question is one for the breeder. If he is incompetent he blames the hen and talks darkly of nature and her laws (which by the way he rarely studies). Look at the history of breeds of other classes of stock; success in every case is due to the breeder, the man behind the gun! Use your brains, develop keen powers of observation, discard any bird in the slightest degree unsatisfactory and success all along the line must be the result.

I prefer single testing to the use of trap nesting, i. e. each pullet or hen in a separate compartment for the whole term of testing with no possibility of errors or mistakes.

I am absolutely certain that the only way to get a flock with a high average egg production is as follows:—

(a) By testing all pullets during the first year before they are bred from.

(b) Selecting such candidates for testing by comparison, i. e. by outward signs such as general character, activity, fineness of head, structure, etc.

(c) Rigid rejection of inferior specimens and those showing any signs of trouble in organs of reproduction, broodiness in non-sitters, etc.

If we use as our basis a strain of birds above the average in egg production I am certain we can by careful selection always keep near the highest point.

Out of 100 first-class layers there would not be more than perhaps 30 really fit for breeding and perpetuating high-class layers. You must line breed all the time. As regards the statement that egg production by a fowl is no indication of that of her pullets, I presume this refers to line-bred birds, because surely no one would be fool enough to mate up an unknown male bird.

Every careful breeder in Asutralia can give ample proof that the good hens breed good pullets when line bred, but there is reason to believe that the production of eggs may vary slightly in succeeding generations. Black Orpingtons and Silver Wyandottes have had special attention in Australia, and a long course of selective breeding has resulted in many strains of high-class layers. Those strains always originate in a good layer. The foolish method of introducing fresh blood is, I am sure, answerable for many failures in other parts of the world.

FEEDING.

Many old breeders say "Given the breeding, the ultimate results depend upon the feeder." This is practically true. Doubtless our climatic conditions are very favorable, but at the same time we have our good feeders and our poor feeders whose results differ so markedly. I often think that much of the food that is recommended by writers not in Australia cannot be suitable even in the country where its use is recommended. The methods of feeding I have strenuously advocated for the past 20 years are as follows:—

Chickens. Fast 24 to 30 hours at least after hatching. First feed coarse sand; after that a mixture of cracked grain fed in litter where the little fellows must scratch and work hard for a living, and so for a month without mash or soft food. After that period a little mash made of various cereals ground and mixed. Here wheat is a

staple, to which I add hulled oats, maize, peas and occasionally millet and canary. Clean water, grit, small charcoal and plenty of scratching material always. Of cut green food they will eat a lot and it pays to give it to them. Do not force them if intended for stock birds or layers. I am not dealing with market birds. The dry mash does not appeal to me and it is not suited to our dry climate. I prefer whole grain. For mash for egg production I prefer a light feed in the morning, fed to the minute. This consists of pollard 2 parts, wheat bran 1 part, to which add of lucerne (alfalfa) chaff steamed, or cut green food, at least a third by bulk. Mix this to a crumbly state with hot soup. The mixing is of the utmost importance, do it carefully and well. At midday the birds generally have a supply of cut green food, of which lucerne (alfalfa) forms the chief part, together with cabbage, kale, green barley, etc., according to the season.

The evening meal is generally wheat, but in the winter occasional recourse is had to peas and maize (corn). At Roseworthy I seldom use oats for adults, but at Kybybolite, in the southeast, that grain is used, especially that variety known as the skinless oat, an excellent poultry food. Shell grit and charcoal are always provided. The yards are small, the houses are open-fronted with scratching shed for use in wet days. The whole floor space of the yards is occupied with straw litter about 6 to 9 inches deep. In this the grain is scattered and it keeps the birds busy all day. The mash is placed in an earthenware dish and another is provided for drinking water which is renewed twice a day in winter and three or four times a day in summer.

I consider that careful and correct feeding is of the utmost importance. Slipshod so-called labor-saving devices generally tend to sickness and loss. Fowls will not thrive and lay unless properly fed. No spices, peppers, or forcing foods of any sort are allowed to be fed, nor are they necessary. Cut green bone is not used, as, although excellent in cool weather, there is great danger of ptomaine poisoning during warm spells. I use meat meal made at the Government Freezing (cold storage) Works; it contains 60 to 70 per cent of albuminoids. This is used for making the soup in the proportion of ¾ of a pound for every hundred adults. I hold that highly concentrated foods affect digestion, and that forcing or overstimulation must have a cumulative and degenerating effect generally.

SOME RESULTS.

There have been six Laying Competitions in South Australia. In the first the average per hen for the twelve months laying was 130 eggs; in the last the average had risen to 190 eggs, and in that now in progress I look for a further improvement.

WHITE LEGHORNS.

In the 1908-9 Laying Competition the average yield per pen of 25 pens, each containing 6 pullets, was 1250 eggs. The highest score was 1447 eggs and the lowest 960 eggs. These 150 pullets were the property of 24 different owners and were of various strains. In the Competition now in progress at the Roseworthy Poultry Station there are 65 pens of White Leghorns numbering 390 birds the property of about 60 owners, and they are of various strains. At the end of eight months, that is, beginning April 1 and ending November 30, the total eggs laid numbered 53,625, or an average of 825 per pen, or 137.5 per hen. There are still four months remaining during which time the birds should lay well. At this period the leading pen has laid 1010 eggs and there are eighteen pens which have laid 900 eggs and over. There are only 49 eggs between the first pen and the sixth and during the next four months a marvellously close contest should be witnessed. I will state definitely, however, that, as regards laying, a steady improvement is witnessed each year. I am confident that, whatever may be the result outside of Australia, here we shall steadily raise the annual production of our White Leghorns. This will take place through the Government Poultry Station and the stud breeders who will distribute large numbers of high-class layers yearly. With the average farmer who is steeped in prejudice and ignorance of the correct methods of breeding we may not expect more than an average increase among pure-bred flocks. Naturally the national gain will be in the gradual displacement of the farm mongrel fowl by the commercial pure-bred. This is rapidly taking place. Publicity through the press and by means of lectures, etc., is gradually showing our country poultry keepers the advantages of the pure breeds. Here farmers buy from noted breeders, and those whose names are constantly before the public as breeders of commercial poultry. The results which make our breeders famous are obtained in officially conducted public competitions. The

difference is that the value of the strains is based on actual fact, not upon the dictum of their owners as stated in advertisements. The public actually buys the correct kind of stock. In the old days the buyers depended entirely upon the results of poultry shows, and one can understand the disappointment and losses of persons who, without knowledge, purchased Cochins and Malays as market egg producers. From a national point of view I consider it is of the utmost importance that the general producer should obtain the proper class of poultry from the best sources. Looked at from a national point of view, the best results can accrue only when the general poultry breeder is thoroughly educated and at the same time supplied with reliable stock. Many of the failures of the past are due to bad stock and improper methods. Much of the lack of success is due to errors in breeding. Each country and climate I think must evolve the particular type of laying fowl best suited. Some of our Australian breeders are mongrelizing the heavy breeds in the endeavor to build laying strains; they gain an increase in eggs but they lose all other qualities. The light breeds are of little value as table fowls, but where they thrive, as in South Australia, they are veritable egg machines.

Dean J. H. Shepperd of the North Dakota Experiment Station reports that the Shorthorn Cattle breeding-circuit, established by the North Dakota Experiment Station and the U. S. Department of Agriculture in cooperation, is in the most flourishing condition. An employee of the Station and the Department gives nearly his entire time to this enterprise. The cooperating breeders are a settlement of German farmers west of the Missouri River, in the southern part of North Dakota. These farmers have already learned to successfully cooperate in the management of a cooperative creamery.

It has been suggested that someone assemble all authentic records of true hybrids of species of animals as well as plants. There are many problems of both scientific and economic value concerning hybridization in animals which our zoological gardens could help to work out. This would be a new and practical use to which some of the material in zoological gardens could well be adapted.

EDITORIALS

THE NEW MAGAZINE.

Since its organization, six years ago, the American Breeders Association has had as its printed exponent the annual reports of its proceedings. These have been received with only commendation, and as annual reports go, have served their purpose well. They have fully demonstrated the fact that there is constantly rising a body of valuable and interesting new knowledge relating to heredity and breeding. The Association has fully demonstrated that there is a common bond of interest between the scientists and breeders, and between plant breeders and animal breeders, which should and does hold them together for a common purpose. Since the Association includes annual, life, and honorary members, also active workers and committeemen, all being in many countries, and has most cordial relations with other associations with which it has much in common, this Magazine will have wide interests.

The purpose of the American Breeders Magazine will be to forward the interests of the American Breeders Association. It will have no capital stock on which to pay profits and will pay only such salaries to employees as are necessary to secure the services of competent editorial and business management, and will have only such expenditures as are necessary to pay for publishing the Magazine. The Association is strictly a co-operative public service organization, which is served by its general officers without pay, and which does not attempt to earn profits. It exists that its members may better serve the common good.

The American Breeders Magazine is not a competitor of periodicals devoted to scientific or practical agricultural, horticultural, or live-stock interests. Its leading specialties are the increase of the knowledge of heredity, creative breeding, and the commercial multiplication of the most useful improved varieties and breeds.

It will secure much of its information, inspiration, and practical points of view from contemporary publications, and in turn will try to make more rapidly available to them the advances along the lines of breeding. It seeks and bespeaks cordial relations with all periodicals interested in all phases of its work. The American Breeders Association will appreciate courtesies from other publications and especially such as are designed to help enlarge the membership of the Association.

The American Breeders Association has assumed the important function of bringing the practical breeders into closer touch with the scientists, and the scientists into a clearer knowledge of the practical problems of the plant and animal breeders. Its meetings have proven the value of an open forum where practical and scientific men interested in breeding can discuss heredity and breeding in all their relations to the living forms as found in nature and in reference to the production of races of plants, animals, and men with better heredity. The Association assumes the publication of the American Breeders Magazine because it feels that there is need of an independent open court for public expression published by a co-operative organization. The Council, under the authority of the Association, in deciding to extend this forum in the form of a magazine realizes both the difficulties and the possibilities of such a step. The effort will be to sustain a high standard of scientific excellence, and at the same time produce a readable magazine. The Association has not been organized to forward the interests of any group of men, but will give a fair and open hearing to all. It aims to achieve scientific and economic results of the highest order and of the widest scope.

The readers of this Magazine may hope to here learn many of the interesting scientific and practical achievements made by the scientists and breeders who are to fill its columns with things useful and things new. This journal will occupy the humble position of a means of intercommunication for the members of the American Breeders Association. It will also be a force in bringing about co-operation and organization of effort. It will find useful work in promoting worthy scientific projects, and projects for the creation of new varieties and breeds. It desires to be not controversial but

informational and inspirational. Those who have new facts or need of facts, or need of new forms of plant or animal life, are invited to come into this co-operative group of workers. Those who are preparing to work as technicians in research or teaching and those who are beginners in creative breeding and in the production of pedigreed plants, seeds, and purebred animals are urged to become members.

It may be assumed that history will repeat itself, and that the science of breeding will continue to bring surprises. This is a fortunate time for the American Breeders Magazine to come into existence. The new achievements in the study of heredity and creative breeding have whetted the public appetite for the rest of the story. Departments of agriculture, State experiment stations, university laboratories, and other institutions which conduct research are constantly increasing the number of workers and enlarging their equipment in this line of effort. The output of newly developed facts is growing yearly in this and in other countries. A most interesting group of scientists is forming—students who make a special study of heredity and breeding. Breeders who endeavor to conduct breeding operations according to scientific principles are rapidly increasing in numbers. The new creations, especially from plant breeding, are a rapidly growing quantity and of great interest. The steady improvement which decade by decade has been going forward in our domestic plants and animals is just now receiving a new and most wonderful impulse. Science is taking hold of the forces of heredity as it has hold of the forces of mechanics, and the Twentieth Century bids fair to be the century of breeding.

The officers of the American Breeders Association have reason to believe that out of the hundreds of thousands of breeders and growers of pedigreed animals and improved seeds and plants some tens of thousands will be pleased to become members and to secure the Magazine and the Annual Reports. With the co-operation of even ten thousand members, the American Breeders Magazine can be made a great success. This periodical is not launched without inspiring precedents. The American Forester, published by the American Forestry Association, is supported by more than twelve

thousand members. The National Geographic Magazine, published by the National Geographic Society, is supported by more than sixty thousand members. What numbers may be our goal no one can at present predict.

H.

THE AMERICAN BREEDERS ASSOCIATION.

The American Breeders Association was organized December 29-31, 1903, at a meeting called for that purpose at St. Louis, Mo. That call was issued by an "Organization Committee" from the American Association of Agricultural Colleges and Experiment Stations.

This Committee was composed of the following named gentlemen: Prof. W. M. Hays, University of Minnesota, University Farm, St. Paul, Minn., Chairman; Director L. H. Bailey, Cornell University, Ithaca, N. Y.; Prof. Thomas F. Hunt, Cornell University, Ithaca, N. Y.; Dr. Herbert J. Webber, U. S. Department of Agriculture, Washington, D. C.; and Dean Charles F. Curtiss, State College, Ames, Iowa.

The first annual meeting was held at Champaign, Ill., in January, 1905; the second at Lincoln, Nebraska, in January, 1906; the third at Columbus, Ohio, in January, 1907; the fourth at Washington, D. C., January, 1908; the fifth at Columbia, Missouri, January, 1909; and the sixth at Omaha, Nebraska, December, 1909.

The five annual reports already issued are permanent evidence of the enthusiastic interest in these meetings, and show the substantial character of the movement centered in this Association. The Association has gradually grown until there are now nearly a thousand annual members and more than one hundred life members. The annual membership fee of one dollar was sufficient to provide for the cost of printing the earlier volumes, and for stationery and postage, but in order to prepare for launching the Magazine the meeting at Columbia, Missouri, authorized the Council to call for a vote of the membership, by means of postal cards, on changing the Constitution so as to make the annual fee two dollars; and this proposition carried by a large majority.

The objects of the American Breeders Association are the advancement of the discovery of the basic facts concerning heredity, the devising of new plans for creative breeding, and the organization of those projects which lead toward improved plants, animals and men. It functions on the skirmishing line to discover the lay of new land, helps to plan the campaign and to direct advances where the largest results may be secured. It is also alive to the work of the great army of active practical breeders which must carry out the bulk of the improvements, and to the interests of those who must use such improved varieties and breeds as are supplied to them in making plant and animal products. Its efforts are directed to the labor of improving the varieties and breeds which serve as implements of production in the hands of the farmer and stockman. Some of its efforts may seem remote from the interests of the producer, as scientific research often does, but all will accord the scientists a liberal scope to the end that every suggested new field may be explored.

The Association promotes and helps to organize cooperation among those interested in studying the laws of heredity, those devising improved methods of breeding the respective species of plants and animals, those engaged in creating new and more valuable types of plants and animals, those who multiply purebred animals, those who produce agricultural products from the newly bred forces and forms, and those interested in eugenics or heredity in man. The American Breeders Magazine is to be the bond and means of communication between all classes who will join this cooperative movement to harness up, and where necessary to recombine in hybrids, the strongest and best units of heredity to be found or created in our plant and animal forces.

The Association's plans do not stop with the study of heredity nor even with the creation of new values in plant and animal forms and forces. They are also directed toward bringing into the widest use all valuable types, as by introduction from one country or district to another, and by aiding in organizing the initial distribution and the widest commercial dissemination in order that the new values shall be secured by all growers. It is believed that much can be done to help owners devise better means for highly accrediting truly superior stocks of plants and animals that they may more generally replace the less desirable forms of both animals and plants. H.

THE RELATION OF THE ASSOCIATION TO PURE RESEARCH.

To the scholastic biologist of our universities the work of the "breeder" has for long been regarded with contempt. Although recognized as a department of commerce, it has been regarded in many quarters as the least dignified department, associated in mind with the cowboy, the stable boy, the "hayseed," the country jay, the peasant of Europe. "What do you do at the meeting of the Association," says my university colleague, "inspect 'hawgs,' pass around 'pertaters' and show up your biggest ears of corn?" But that attitude is changing and changing fast. It is interesting to note the reasons. For one thing, the factors of evolution were always regarded as worthy subjects of research; and the old method of discussing evolution without facts had fallen into disrepute. It became recognized that the experimental method should be applied to the behavior of the germ plasm of plants and animals. Meanwhile the work of the Agricultural Experiment Stations and that of medical investigators, who experiment largely with domesticated animals and breed them for their work, made pure biologists acquainted with the valuable experimental material offered by such organisms. And so, from many sides, as though by a common impulse, the scientific investigation of biological problems involving experimental breeding began. The American Breeders Association was organized just at the most opportune time and in this country has served as a great clearing house for the results of experimental breeding both on the part of the pure and the applied biologists. By a fortunate disregard of the conventional distinction of plants and animals, breeders of all organisms are thrown together in a close relation which has not been successfully reproduced in the breeders' society of Germany.

The future of research in breeding is bright. The topics of heredity, of effect of consanguineous matings, of reciprocal crosses, of influence of soma on germ plasm, of the origin and significance of the characteristics of organisms, of the laws of combinations of characteristics, and especially of the nature and determination of sex and of secondary sex-characters—these and many other topics of great biological import are now, and in the future still more are to be, the objects of pure scientific investigation by well-trained biologists, using the experimental method. Such investigation is now for the first time being systematically undertaken.

This new Magazine will, it is confidently expected, become not merely the archive for the results of these researches, but the forum for the discussion and interpretation of these results. It will use the most practical methods of aiding in the advancement of pure biological research in the field of breeding.

CHAS. B. DAVENPORT.

BUILDING UP AN EXPORT TRADE IN PEDIGREED ANIMALS.

There is no business in which there is greater opportunity for deception than in trafficking in pedigreed live stock. It follows therefore that there is no business in which the integrity of the breeder counts for more. Because of the opportunity of securing greater temporary pecuniary gain by deception, individual breeders have occasionally resorted to a variety of questionable practices which have had a tendency to destroy public confidence in pedigreed live stock. It is doubtful whether breeders of the United States are yet as skillful in this regard as those of other countries, but experience teaches us that they are apt scholars.

Breeders who have at heart the best interests of general live-stock improvement and pedigreed live stock in particular (and fortunately there are many such in this country) understand that, aside from any moral question involved, deception of any sort is a short-sighted policy. It is unfortunate that reliable breeders are constantly forced to compete in the show and sale rings with the unscrupulous. Obviously, it is often the unscrupulous that win.

If such enemies of the pedigreed live-stock business would confine their practices to domestic trafficking their influence would be less diastrous. But those seeking pedigreed live stock in a foreign country are, for various reasons, peculiarly susceptible.

The possibility of securing in the United States pedigreed live stock of sufficiently high quality to compare favorably with that available elsewhere and usually at prices that are distinctly attractive is becoming a matter of common knowledge, and as a result there is a steady increased foreign interest in our improved live stock.

No one will deny the desirability of building up an extensive trade with foreign countries; it should follow logically a decline in

exports of market animals. It is not too early, therefore, to give some serious attention to this trade. Should not the American Breeders Association, through a committee, undertake to render assistance and advice to foreigners seeking pedigreed live stock in this country to the end that they may have an opportunity of seeing and securing our best?

HERBERT W. MUMFORD.

EUGENICS, A SUBJECT FOR INVESTIGATION RATHER THAN INSTRUCTION.

We learn of a Eugenics Education Society in England and of an international Eugenics "movement" originating in Germany, and we hear the inquiry: Why is not a Eugenics Education Society started in America to take part in the propaganda? When told of the Eugenics committee of the Breeders Association some of these inquirers can barely restrain an expression of disgust that human interests should thus be mixed up with those of domestic animals and plants. It may, however, well be doubted if the time is ripe for education in Eugenics. Only within the last decade have we begun to learn how to investigate heredity so as to give definite results; and the facts have only begun to come. How can one, then, educate others until one is himself instructed? Lest we be blind leaders of the blind, we must first of all investigate. When precise laws of heredity shall have been determined for many human characteristics, it will be time enough to instruct the people in regard to them. Premature attempts at education will bring the whole business into deserved reproach; and will the longer defer the acceptance by the common people of the facts when ascertained. Our greatest danger is from some impetuous temperament who, planting a banner of Eugenics, rallies a volunteer army of Utopians, freelovers, and muddy thinkers to start a holy war for the new religion. The association of research in Eugenics with the American Breeders Association is a source of dignity and safety. It recognizes that in respect to heredity man's nature follows the laws of the rest of the organic world. It recognizes that human heredity is a subject of study for practical ends; the ends, namely, of race improvement. The Eugenics committee or Section of the Breeders Association will preserve by

virtue of its affiliations that ideal of hard-headed, critical, and practical study that characterizes the work of our best plant and animal breeders.

In the attempt to get facts the Committee on Eugenics is distributing blank family records, wherein may be recorded some 35 characteristics for each of these generations in the direct lines, and additional data for collaterals. These are sent to persons applying to the Secretary of the Committee, C. B. Davenport, Cold Spring Harbor, N. Y., who will send also, when desired, an additional copy to be retained by the collaborator. The records already returned to the Committee constitute a mass of data of the greatest value. Scores of pedigrees, many made out with the greatest care, far beyond the limits asked for in the blank form, have been presented, showing the inheritance of such special characters as stammering, hairiness, and peculiar finger movements. Already important generalizations have been made regarding the inheritance of certain diseases. But more facts are needed and volunteers are urgently called for.

CHAS. B. DAVENPORT.

EFFECT OF RECENT DISCOVERIES ON THE ART OF BREEDING.

The breeder's art has been profoundly modified by discoveries made within the past decade, yet we are only at the beginning of a new era in which a knowledge of the principles involved gives us a science of breeding. Certain broad fundamental principles have been made out, but there is much detailed work which must yet be done before these principles can be applied universally. The first discovery of importance was, of course, that of Mendelian principles. These principles are three in number: first, the principle of dominance; second, the law of segregation of character pairs; third, the law of recombination.

The full extent to which these principles can be applied in breeding is not yet known. That they are important is evident to all. There is much yet to be done in working out the so-called unit characters. Although the principles are new, some important applications have been made of them. Breeders of Polled Hereford cattle are making deliberate use of Mendelian principles to their great advantage in dehorning one of the important beef breeds of the

country. Breeders of other polled breeds are generally familiar with these principles and are making use of them. Many new varieties of our leading crops have been produced by the deliberate application of the law of recombination. Some of the hybrid wheats produced at the Washington Experiment Station in this manner have assumed an important rôle in that state. Nilsson, at Svalöf, Sweden, is now engaged in producing new varieties of many crops, deliberately planning beforehand the combinations of characters he wishes to make. Many other practical breeders are doing the same.

One other very important principle, which has only been generally recognized within the last few years, is beginning to have a profound effect upon the practice of breeders. This is that selection within pure lines, either of vegetatively propagated crops, like potatoes, fruit trees, etc., or in self-fertilized species, like wheat and oats, is without effect in changing the characteristics of the crop, except for the rare evolutionary changes that occur in such species. Recent investigations indicate that these evolutionary changes are so infrequent that the only use the practical breeder can make of them is in the case of old varieties which have split up more or less into different types because of such changes. Selection enables the breeder to segregate the most desirable types in such a population.

One of the most important things accomplished by scientific discovery, in relation to the art of the breeder, is the dissipation of the old idea that practically unlimited improvement can be made by selection. It is now the consensus of opinion, amongst the leaders in this line of work, that selection can only accomplish the segregation of the best strains in the populations selected. It is only in cross-fertilized crops that marked effects can be produced in changing the character of the crop, and even in this case all that can be done is to secure the most favorable combinations of characters present in the original population.

There is, of course, danger of claiming too much for newly discovered principles. It remains for the future to demonstrate just how much value the discoveries hitherto made have to the practical breeder.

W. J. SPILLMAN.

ASSOCIATION MATTERS

THE OMAHA MEETING.

The Sixth Annual Meeting of the American Breeders Association was held at Omaha on December 8, 9, and 10, 1909, the Association being the guest of the National Corn Exposition. The meeting was well attended, in spite of a snowstorm which made travel difficult. The papers and discussions compared well with those of previous meetings. The same spirit of mutual interest between scientists and practical breeders and between breeders of plants and breeders of animals which has been manifest at all previous meetings was again abundantly shown.

The interest in the work of the Association expressed by the local press and by citizens and visitors at the National Corn Exposition demonstrated the cordial feeling which exists in the public mind toward the work of the Association. No previous meeting had accorded to it nearly the number of notices by the daily, agricultural, and scientific press as had the sixth annual meeting. It would seem that the American Breeders Magazine was to be born into a very congenial atmosphere.

Besides marking the time of the organization of a magazine, the Omaha meeting will be remembered as the date of the initial action to enlarge the scope of the Committee on Eugenics, by the proposal to make it into a third section of the Association. And whether the membership votes to change the Constitution at this time or not, the proposition marks the date of public recognition of this neglected but important line of inquiry. The election of Professor Hugo DeVries of Amsterdam, Holland, and Dr. William Bateson of Cambridge, England, to life membership is a matter of personal interest to their many friends on both sides of the Atlantic.

In the absence of the President, the Honorable James Wilson, Secretary of Agriculture, the Vice-President, Mr. William George of Aurora, Illinois, presided. In assuming the chair he called attention to the work of the Association and discussed the desirability of our country working out systems of pedigree breeding which will

better accredit our pedigreed stock so that they will be more in demand at home and abroad. Under his leadership members present made pledges to secure more than eleven hundred new members. These members are now making good their promises.

The papers presented will form the bulk of the scientific discussions in the four numbers of the American Breeders Magazine for 1910, and in the Annual Report. Some of the discussions of papers will also be given.

The following officers for the year 1910 were elected:

Hon. James Wilson, President, Washington, D. C.
Hon. William George, Vice-President, Aurora, Illinois.
Hon. W. M. Hays, Secretary, Washington, D. C.
Hon. N. H. Gentry, Treasurer, Sedalia, Missouri.
Dean C. F. Curtiss, Ames, Iowa, Chairman Animal Section.
Prof H. W. Mumford, Urbana, Ill., Secretary Animal Section.
Dr. H. J. Webber, Ithaca, N. Y., Chairman Plant Section.
Prof. N. E. Hansen, Brookings, S. Dak., Secretary Plant Section.

On motion the naming of the magazine was referred to the Council with power to act.

On motion of Dean J. H. Shepperd, the Council was authorized to present the compliments of the American Breeders Association to the American Association of Agricultural Colleges and Experiment stations, under whose auspices this Association was founded.

On motion of Messrs. Spillman and Shull, Professor Hugo DeVries, Professor of Botany in the University of Amsterdam, and Professor William Bateson of Cambridge, England, were elected honorary members. Both of these gentlemen have accepted this honorary membership.

The Association is peculiarly indebted to Mr. Charles Dickinson, of the W. A. Dickinson Seed Company of Chicago and Minneapolis, for the first contribution to be used in establishing the American Breeders Magazine on a basis commensurate with the work it has to perform. It was of material assistance in printing the first issue of the Magazine.

THE COMMITTEES OF THE AMERICAN BREEDERS ASSOCIATION.

The membership lists of the committees of the American Breeders Association are now being revised. Suggestions are in order from any member as to the work of the existing committees, and as to new lines of work which might properly be taken up by committees.

It will be observed that most of the papers as well as the formal committee reports come to the Magazine and to the Annual Report through the committees. Thus the committee chairmen become assistant editors, and greatly enhance the value of the Association's publications. It is desired that the committees be made even stronger centers of work for the objects of the Association.

It is suggested that for the next year or two these committees which have charge of reporting on the improvement of classes of animals and classes of plants offer specific methods of breeding. Thus the Committee on Breeding Dairy Cattle might make a general committee report outlining a plan under which a private breeder can build up a herd of Jerseys, Guernseys, Holsteins, or other breed. The Committee on Breeding Sheep might offer plans prepared by different members outlining a method of procedure to be followed in forming a flock of pedigreed sheep, as of Rambouillets in Montana, a flock of Shropshires in Iowa, or a flock of Horned Dorsets in Michigan. The Committee on Breeding Fish might suggest a plan of improving a given species of Pennsylvania mountain stream trout; or a plan of producing hybrid breeds of trout. The Committee on Breeding Poultry might offer specific plans for building up families of Wyandottes, Orpingtons, or Leghorns with high annual egg laying efficiency. And the Committee on Co-operative Animal Breeding might outline a definite circuit breeding plan of producing high class drivers in the valley of Virginia.

In like manner, the Committee on Breeding Forest and Nut Trees might outline plans for breeding black walnuts in Kentucky, breeding pecans in Texas, and breeding birds-eye maple in Michigan. The Committee on Breeding Cotton might outline a plan under which the Oklahoma Experiment Station could produce varieties which would thrive under the relatively dry climate of western Oklahoma, or show how a farmer could breed varieties adapted to grow along

the northern zone of the cotton belt in Missouri and Tennessee. The Committee on Breeding Vegetables could outline a plan for breeding cantaloupes suited to grow along the northern zone of cantaloupe growing in Minnesota, Wisconsin, and Michigan. The Committee on Breeding Cereals could suggest the line of work which might be taken up in breeding wheat or oats at a branch experiment station, as at Crookston, Minnesota, or in Oklahoma.

The Committee on Breeding Forage Crops might offer a plan under which an experiment station in Illinois, Pennsylvania, Virginia, or Alabama might undertake to introduce and breed varieties of alfalfa suited to the several soil conditions of the State. And this same committee might offer plans under which a farmer might create a variety of alfalfa for the soil and climatic conditions of the county or valley in which he resides. Or this same committee might outline a plan under which the farmer or seed dealer in Minnesota can have his stocks of seed of hardy Minnesota alfalfa raised in Idaho and surrounding States and shipped to dealers for sale to his Minnesota farmer patrons.

The best types of this class of articles which will appear from time to time in the American Breeders Magazine and in the Association's Annual Report will give suggestions as to the form of such statements. The Association is now in position to assist in multiplying efforts at creative breeding. And on the quality of these statements as they may be published, and republished under revised form from year to year, much will depend. Their fruits will be in the form of more bread, meat, fruit, and fiber for the food and raiment of the whole people. The Association is attracting to its membership many men in foreign countries. Of no little interest and value will be their contributions to these practical plans for breeding specific animals and plants.

This class of subjects will greatly broaden out the contributions to the Magazine, by bringing out the thoughts of those practical breeders who are doing things in actually increasing values in this or that species, breed, or variety. The theoretical discussions from those who devote themselves to scientific work in heredity and breeding will be the more valuable because of the influence these writings will have among those practical breeders who are seeking mutations, and are building up new methods of controlling descent, and those who are introducing new plants and animals; or those who are es-

pecially interested in giving the widest dissemination to the most valuable standard varieties. Besides, it is only by the scientists' learning of the specific and general problems of practical breeders that they can gain for their work a practical direction.

The Secretary most earnestly requests that members communicate with him and with committee chairmen concerning this matter. If you have a plan which should be presented in the Magazine or Annual Report, or if you wish to make suggestions concerning specific plans for breeding a certain class of animals or plants, write your wishes to the officers of the Association.

PROPOSED CHANGE IN THE CONSTITUTION OF THE AMERICAN BREEDERS ASSOCIATION.

Notice is hereby given to members that the following amendment to the Constitution of the American Breeders Association was proposed and discussed on December 9 at the Annual Meeting of the Association; and upon an affirmative vote of the Council is recommended for adoption by vote of the members of the Association:

In Article IV of the Constitution in two places put a *comma* in place of the word *and,* between the words *Plant Section* and the words *Animal Section;* and after the words *Animal Section* where first used, place the words *and a Eugenics Section,* and where used the second time, the words *and of the Eugenics Section;* and change the word *seven* to the word *nine;* and change the word *either* to the word *any.*

In Section XIII of the By Laws put a *comma* in the place of the word *and* between the word *Plant* and the word *Animal,* and place the words *and Eugenics* between the word *Animal* and the word *Section.* In Section XV remove the word *and* between the words *Animal Section* and the words *to the Plant Section,* and after the words *Plant Section* insert the words, *and to the Eugenics Section;* and substitute the word *shall* for the word *will.*

This amendment proposes to raise the status of the Committee on Eugenics to a third section of the Association, along with the Plant Section and the Animal Section. The argument is made that this section is growing so rapidly in its work that the sectional organization with committees, rather than the committee organization with sub-committees, would facilitate and strengthen its work. Those most

concerned have expressed the belief that a section of the American Breeders Association provides at present more logical auspices for this movement than would a separate organization. The Committee on Eugenics has grown rapidly and now has nearly twenty members. There are six or eight sub-committees, each of which would become a committee. This will also raise the number of members in the Council from seven to nine by the addition of the Chairman and the Secretary of the Eugenics Section.

The ballots will be mailed to the members after this number of the Magazine is mailed. All members whose dues have been paid for the year 1910 and who return their votes within thirty days after this notice is mailed are entitled to vote. Please indicate your vote, sign, and mail to the Secretary's office at your early convenience.

W. M. HAYS, *Secretary.*
For the Council.

MEMBERSHIP IN THE AMERICAN BREEDERS ASSOCIATION.

The fiscal year of the Association begins December 1st of each year.

Members are entitled to the Annual Report issued in the fiscal year in which membership is taken.

Unless wish is expressed by a new member at the time of joining, to have the Magazine begin with a certain number, the first number sent will be of the issue nearest the date of receipt of membership.

THE ANNUAL REPORT.

The supply of Volumes I, II, III, and V of the Annual Report in the office of the Association is exhausted. A number of Volume IV are still on hand and can be furnished to new members and others at the price of $2.00 per copy post paid.

Volume VI will be published at the end of the year. Separates of any article will be printed at actual cost, at the author's request.